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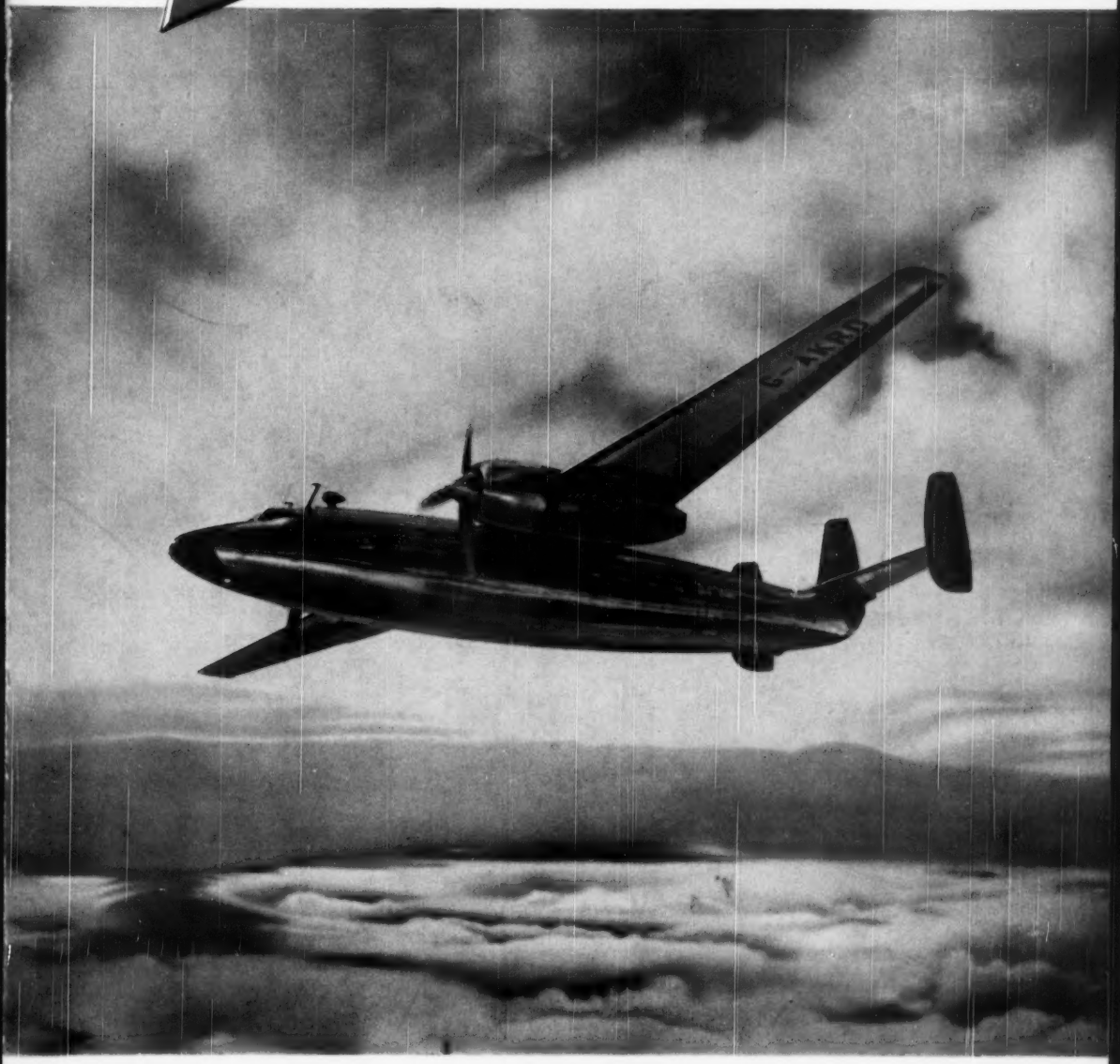

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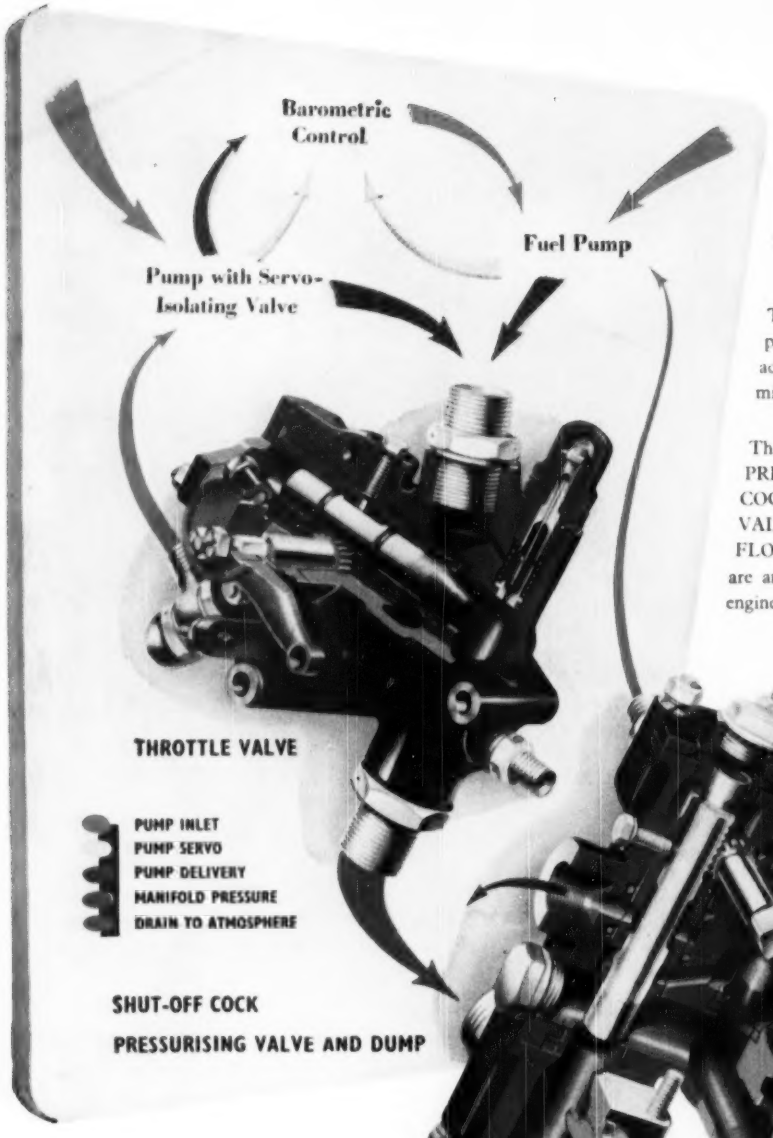

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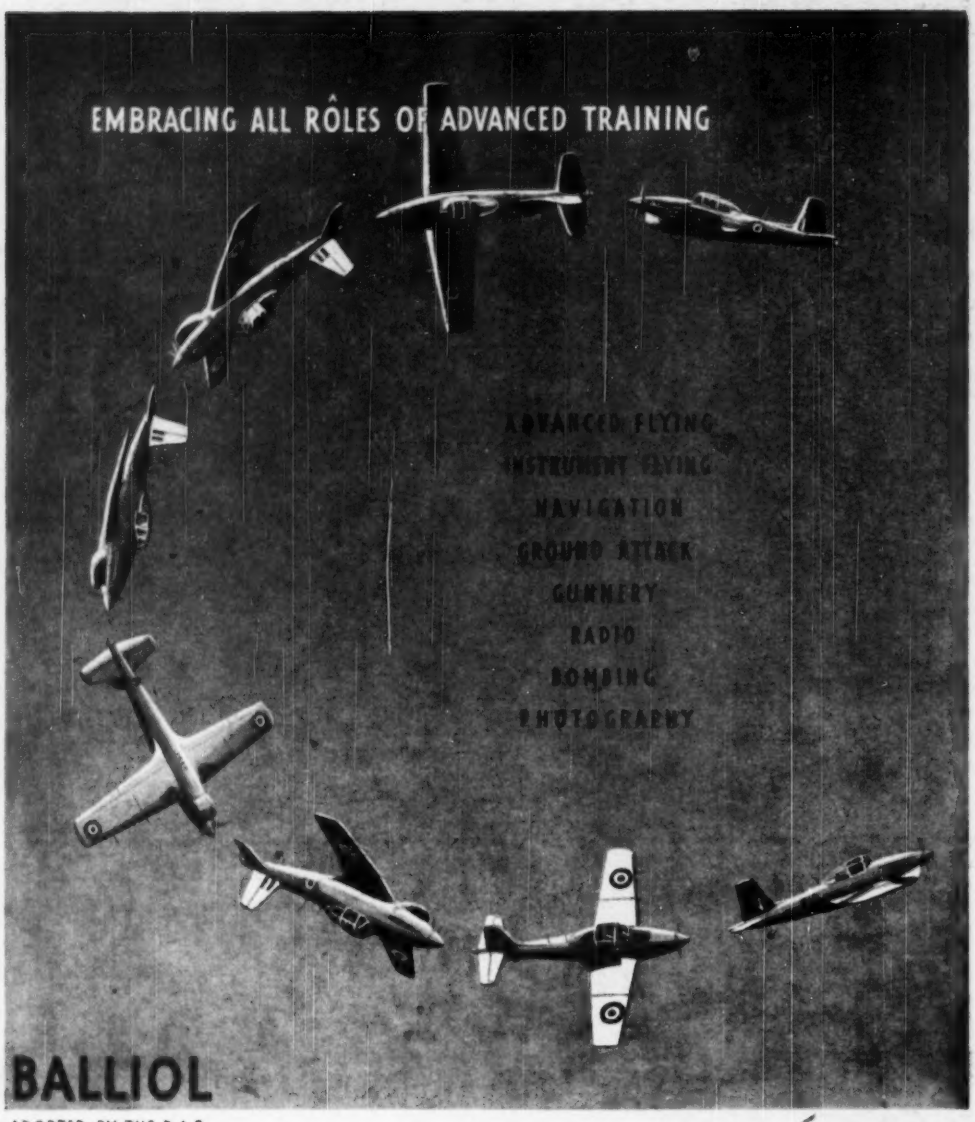

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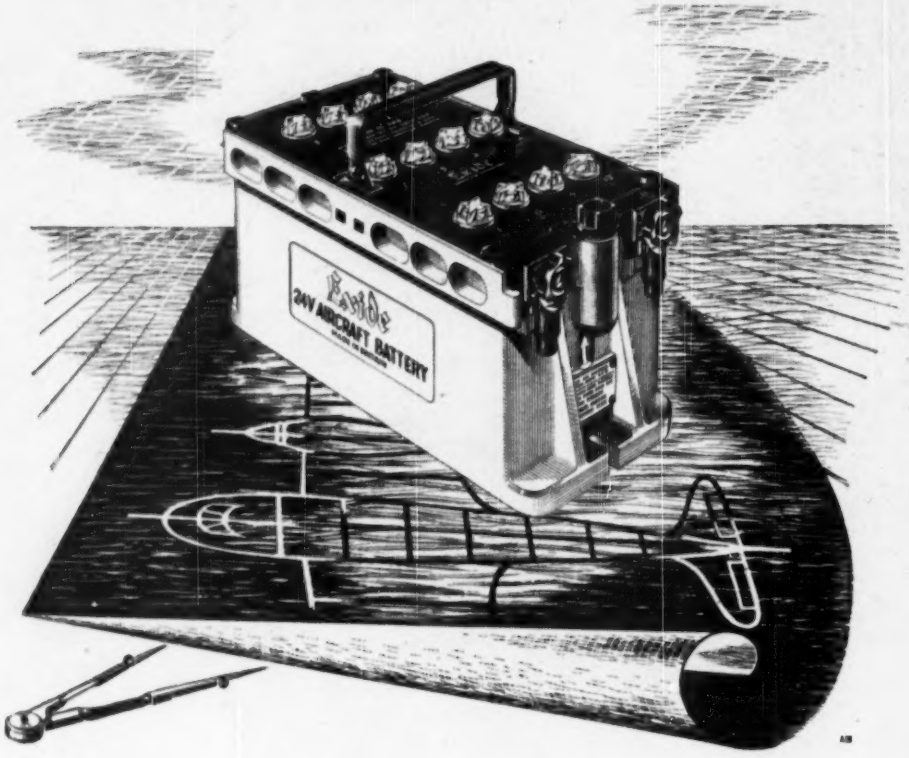

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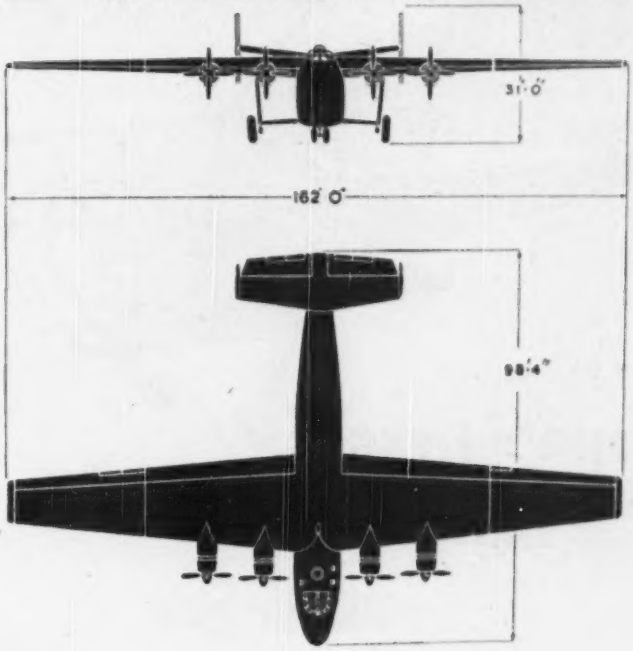

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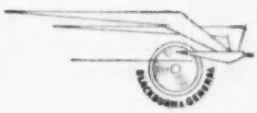

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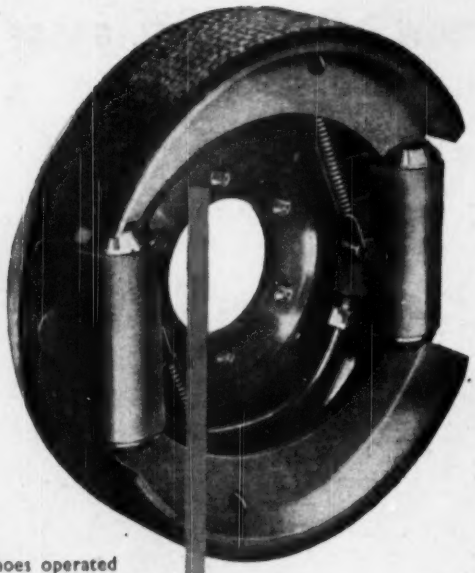

THIS brake consists of two self-aligning shoes operated by two wheel cylinders spaced diametrically opposite. Each wheel cylinder has two pistons of a different form: one having a slot at right angles to the axis of the bore, which operates the shoe when the brake is used in forward rotation and the other with the slot inclined at an angle to the bore which forms the abutment for the other shoe in similar condition. This inclined slot has a predetermined angle which allows the shoe to align itself accurately to the drum as well as forming the abutment. The total shoe reaction is transmitted via a shoulder on the piston to the cylinder body. By this arrangement, two-leading shoe operation is obtained in either direction, and greater power for a given input and greater stability is obtained.

TYPICAL FIGURES

5¾" x 1½"	Approximate maximum dynamic torque 2,950 lbs. inches, at 60 lbs. per sq. inch lining drag. Two ¾" diameter cylinders.
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Founded 1909

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New Wine . . .

INTIMATION has been given in these pages from time to time of the earnest (some would say feverish) efforts of American manufacturers to meet the challenge of new British airliners by adapting existing airframes for turbojet and turboprop power. The first to fly will be the Convair-Turboliner. Initially this type will be used for power-plant development-flying with the Allison Division of the General Motors Corporation, but already Convair are advertising the possibilities of "inexpensively" converting the Convair-Liners now in service with thirteen operating companies to take Allison turboprops.

It must be admitted that the Convair-Liner and its less widely adopted competitors, the Martin 2-0-2 and 4-0-4, appear to be well suited for conversion (as, of course, is our own Airspeed Ambassador); but we have not heard that any American developments to date have noticeably perturbed the Vickers-Armstrongs and Armstrong Whitworth staffs responsible for marketing the Viscount and Apollo. These—the world's first medium airliners to be designed specifically for turboprop power—remain unchallenged in their field. Nevertheless, British manufacturers will be prudent to note that though the sum of American achievement in this field remains nil, ambitious schemes are afoot for large-scale conversion, not only of medium-size transports but of the largest types of trunk-route airliners.

Douglas and Lockheed are planning turboprop developments of the Constellation and DC-6, and the vice-presidents of both companies have declared that conversion would be relatively cheap, and that it might be effected in from three to four years. By the use of this modernized equipment it is hoped to reduce the New York-Los Angeles flying time to little more than seven hours—nearly four hours faster than the best existing schedule. But though modernization might temporarily soothe the Comet-troubled breasts of American operators, leading U.S. constructors are uncomfortably conscious of the inevitable demand for a pure-jet transport, capable of crossing America in 5½ hours. Mr. Hall Hibberd, of Lockheed, has frankly confessed, in fact, that though he has hopes that the life of the Constellation may be increased by about five years, he is "more interested" in turning out a 600-m.p.h. turbojet transport. He considers that such a development is likely "by 1954 or 55." Mr. Carlos Wood, chief designer of Douglas, is of the opinion that transition by way of the turboprop would give American airlines their best chance "to make some profits" before turning to turbojets, which he, likewise, predicts "by 1955." This matter-of-fact statement he goes on to qualify by doubting whether the airlines could afford turbojets by the time stated.

The intentions of the Boeing company in developing pure-jet airliners from the basic Stratojet bomber design were discussed in "American Notebook" last week; but, again, this company has interim plans for developing its existing commercial Stratocruiser to take turboprops. Schemes exist, moreover, for adding "podded" turbojets to the current piston-engined version, and even a pure-jet variant has been mooted. The basic Stratojet structure and aerodynamic design are claimed to be suitable for higher speeds and increased pressurizing differential, and calculations are reported to show that shorter runways may be utilized, even at increased gross weights. The weight-saving afforded by the turbojets might be utilized for an extra 840 gallons of fuel.

Operators and builders alike must be aware that schemes such as the foregoing—promising as they may be by virtue of inherently sound airframe design—are dependent upon greatly accelerated development flying of American turboprop units. Nevertheless, it is clear that the turboprop is assured of an important commercial future. This being so, satisfaction may be felt in this country that the Handley Page Hermes V has already been flying for nearly a year and that the proposed piston-engined version of the Bristol Britannia has been abandoned, the green light having been given to concentrate resources on the model with Proteus turboprops. Increasing regret is being expressed that development of the highly promising Rolls-Royce Clyde should have been shelved for non-technical reasons.

PRINCE in the Air

Impressions of a Pleasing Feederliner with Crew Trainer and Survey Versions

No. 38 OF THE SERIES

By THE EDITOR

WHEN a practical and likeable aircraft—the result of private venture and enterprise—reaches the stage of fruition and orders are obtained, there are few, even among rival companies in the industry, who are not delighted. The extent of the orders for the Percival Prince have not been revealed, but it is known that in addition to a substantial number from the Royal Navy for a long-nosed crew-trainer version, a good many more have been ordered by commercial concerns at home and abroad—among them, we note from our contemporary *Aviation Week*, no fewer than nine for the Shell Company.

When a concern as large as an airline corporation, for example, has decided that a certain type of airliner, American or British, is best suited to its needs, negotiations may be opened with the manufacturers, and whether or not it initially costs £250,000 or £280,000 is not of paramount importance. In the case of such aircraft as the Prince, a modest and businesslike 8-12-passenger feederliner, costing less than the difference between these two figures, the position is very different; although there may be several companies, British and foreign, which would like to operate a fleet of such aircraft, few can afford the £25,000-odd which each such machine costs—especially when they can contrive to get by for a year or two longer with the aid of second-hand and war-surplus machines available at a fifth or less of that figure. In such circumstances the modest sales success of the Prince to date is the more creditable. A production line is now beginning to move and nine aircraft have been completed so far.

Since it was first seen, the Prince has been improved in appearance by the fitting of a new windscreen and elongated nose, and also of a shapely, curved fin and rudder with dorsal extension. It is now a friendly, rotund machine, offering above the average performance and comfort. Its Alvis Leonides engines are very smooth and powerful for their size and, following many years of test and development, await only further operational experience to obtain an even longer period between overhauls. To date, it is learned, the Leonides have given excellent service.

Having studied the Prince and watched its progress with close interest, it was a pleasure last week to sample its flying qualities from the pilot's seat and to find—not unexpectedly—that it has a performance in keeping with its character and trim appearance. The more types I am privileged to fly, the more conscious I am of the inadequacy of a mere hour or two at the controls in which to assess any one of them. Consequently, it seems best to confine my experience to the normal flying behaviour and the few most probable emergencies, filling in the gaps with the aid of discussions with, and examination of reports from, those with a great deal of experience on the aircraft.

The Prince cockpit has undergone some small improvements of late, and the new main instrument-panel layout is illustrated. Its simplicity is apparent, as is the handiness of the control positioning. For all ordinary flying the panel levers and switches are adequate, and lavish illumination (both of direct amber and fluorescent type) is provided, but for long periods of night or instrument flying the second pilot might call for a blind-flying panel of his own. There is little doubt that to have a horizon, A.S.I. and the rest directly in front of the pilot is the ideal. Windscreen wipers are provided for the wide and deep screen, and on production aircraft they are tucked away as unobtrusively as possible. Personally, I would like adjustment for angle of the seat-backs as well as for seat height. At present they are rather upright.

From the passenger's point of view there is ample comfort for the short journeys in mind, and a good view. Only during the few minutes of take-off, when everything gets buzzing, is there any noteworthy degree of noise or vibration. Otherwise, the neatly cowled Alvis radials are commendably vibration-free and quiet.

On starting-up, the Leonides idle smoothly at about 1,200 r.p.m. Electric fuel-tank cocks and boosters are on

(indicator green lights confirm operation, as do the sound effects over the intercom.), but the cross-feed cock remains off. Two buttons are pressed for a cold start, one for the starter proper and the other for the priming valve.

The main services—wheels, flaps and brakes—are pneumatically operated. Each engine carries a compressor and an air cylinder, port and starboard cylinders being connected by a balance pipe. In addition, the port compressor serves a second port-side cylinder for emergency operation. This system is brought into use independently of the main controls by two valves on the port side of the main panel.

Having discovered this much while the Leonides warmed up, we called for chocks away and taxi clearance from the tower. Control on the ground is adequate, though not the best of the Prince's features. A hand-brake lever is provided on each of the "open w" control wheels, and the rudder (adjustable for reach by means of a star wheel) provides differential action. The nosewheel is coaxed round as required with brakes and engine, and, when bowling along over the irregular grass surface at Luton, the Prince is found to be well sprung and to offer a quite remarkably good view forwards, sideways, above, and almost literally, below. To be fair, it must be added that the aircraft I flew—an early model and the one, in fact, which made the tour of Africa—is awaiting the removal of surplus friction washers in the nosewheel system. They became obsolete when possibilities of shimmying were removed by re-rigging the nosewheel in the near-vertical position. Steering on the ground is reported to be much simplified on production aircraft.

The brief take-off check is concerned with trimmers (all neutral except for elevator, which is placed at ½ deg forward into the black sector); pitch, full fine (3,000 r.p.m. at 43in Hg for take-off); flaps at take-off gate; oil cooler manual controls, full or part-open according to temperature.

With the Prince properly lined up, the throttles may be opened quite quickly without any tendency to swing. As speed increases—as it does unusually quickly—the nosewheel is pulled off the ground and then held. This occurs at about 60 m.p.h. Shortly afterwards, with pull load on the stick, to hold the nosewheel up, diminishing, the aircraft flies smoothly off at about 95 m.p.h. (100 m.p.h. at max. a.u.w.). She is ready to climb steeply almost immediately, and the wheels are fully retracted in about 20 seconds. Flaps follow wheels at 200-300ft, and the angle of climb to maintain the best climbing speed of 120 m.p.h. is unusually steep. Continuous climbing is carried out at 2,900 r.p.m. and 36in boost, and at between 8,000 and 9,000 lb a.u.w. this gives an indicated rate of over 1,200 ft/min. Pulling up wheels and flaps causes a small nose-up trim change, and in the latter case a very slight sink.

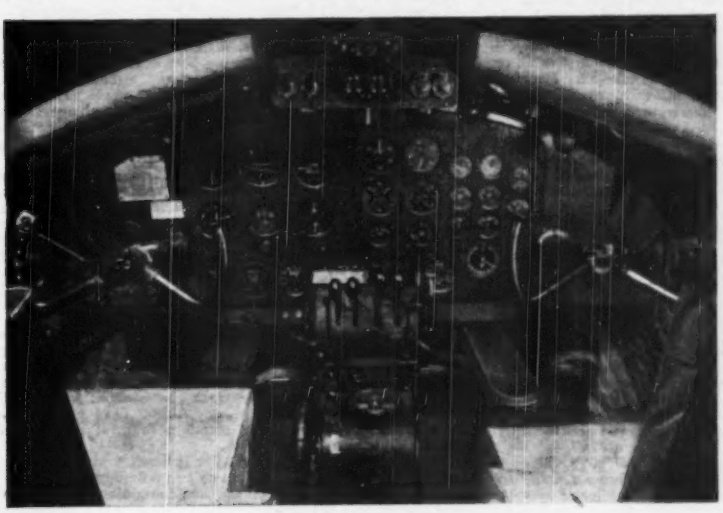
I did not try any engine cuts on take-off, but measured tests indicate, for example, that with starboard engine feathered, flaps at take-off and u/c still down, the climb is just over 100 ft/min at 110 m.p.h. at maximum weight (10,650 lb). When the wheels are up the climb increases to 290 ft/min. With wheels and flaps both up, climbing power will provide a full-load climb of 200 ft/min. For a short period while climbing away from the field, with wheels and flaps both up, the port engine was feathered. With take-off power and slightly reduced weight, the climb was indicated as about 500 ft/min. Direction was easily held with rudder at 120 m.p.h.; a few degrees of rudder trim accounted entirely for the asymmetry and a hands-off climb was then possible. Normal level flying was much the same as with two engines running.

All three controls are light and smooth in operation, and the ailerons are especially effective. Little use need be made of the rudder for ordinary flying, and thus it is no disadvantage to find it slightly heavier than the other two controls. The controls remain effective and positive down to the stall, and there is no appreciable tightening-up accompanying the nose-up trim change on the way up to 220 m.p.h. I.A.S., the highest speed at which I flew. A top-speed limit of 250 m.p.h. (217 kt) is quoted.

Weak-mixture cruising conditions are 2,600 r.p.m. and 30in boost as a maximum, and these—64 per cent of take-off power—give a speed of 190 m.p.h. At 2,200 r.p.m. and 28in, which I used for stooging, the indicated speed at 1,500ft was about 160 m.p.h. This setting represents just under 50 per cent power.

Stalling is unlikely to cause any trouble, being entirely normal and straightforward, with plenty of warning. I tried stalls, engines off, with everything up and everything down. In the former case the speed was near enough 90 m.p.h. I.A.S., and in the latter case, 75 m.p.h. The onset was marked with gentle buffeting, and when completely stalled this felt more pronounced, particularly in the elevators. Recovery is rapid, and a little engine power seemed to smooth out the buffeting even before speed started to build up and full control return.

Time was found to make a couple of take-offs and landings, and in both the experience of the first enabled me to improve the second. On the first take-off I continued for a little too long the hard early pull required to raise the nosewheel, and consequently leaped off the ground a little too steeply. The attitude on the ground seems slightly nose-down, and one feels particularly close to the grass. On



The Prince has a single, large, flexibly-mounted panel carrying engine instruments on the starboard side; to port is the standard flying-instrument layout. On the pedestal, paired throttles (left) and airscrew levers (gated for feathering and later to include reverse-pitch braking) are flanked by undercarriage and flap levers. Also seen on the pedestal are the three trimmers with their indicators, operating in natural plane and sense. A starting panel is located centrally above the main instrument panel; the emergency panel, with oil-cooler-flap controls, is centrally in the roof; the pilot's switch panel is on the cockpit port side; and the fuel-control switch panel (with the cabin-heat lever) is on the bulkhead above the cockpit door. The flying-control locking device is seen engaged, with its safety bar across the quadrants.

PRINCE in the Air . . .

my first landing, in spite of having thought it out in advance, I got the tail rather lower than necessary—not that it mattered much or caused any touch-down trouble. What appears to be about level and a foot or so off the ground is the best hold-off attitude. A light backward stick force (i.e., trimmer left a fraction forward of the no-load position on the approach) is held steadily, and the Prince then sinks on to the ground as power is cut right back. The nose pitches down (a few inches only) shortly after the main wheels have touched, and a very steady landing run follows. The likely fault at first attempt is to hold off rather too high and with tail too low. Certainly the approach and landing present no real difficulty and can be quickly mastered.

To return to the actual experience, a circuit speed of about 140 m.p.h. seems comfortable, and wheels can be lowered when ready (max. lowering speed 150 m.p.h.). Once they are down nearly 30in boost is required to hold speed and height for the last cross-wind turn and the commencement of the approach at about 120 m.p.h. Take-off flap was lowered for the final turn, the speed then being about 105 m.p.h. (limitations for take-off flap = 127 m.p.h., 113 kt; for full flap = 116 m.p.h., 106 kt).

Final approach angle—with full flap and light wind—was quite steep at 100 m.p.h., and view and control were excellent. At the intermediate weight concerned, 90 to 95 m.p.h. would have been quite safe. The round-out calls for only a gentle pull on the wheel, though the elevators would certainly not be described as unduly sensitive and, as already mentioned, very little hold-off action is required. Rather is it better to let the Prince fly or sink on from a near-level attitude.

The brakes, smooth in action, are powerful enough to skid the main wheels, though judging from warnings to the pilot in some preliminary handling notes care must, as is usual, be taken to prevent over-heating damage.

Without necessarily wishing to conclude on a complimentary note—for it is not *Flight's* policy to praise unduly or to omit criticism—it may be said that there is little doubt that those who are given the job of piloting the Prince will like it very well. It has big-aircraft substantiality and smoothness together with the liveliness and lightness of control of a small aircraft. In addition, it is roomy and provides a superlative view from the cockpit.

PERCIVAL PRINCE 8/12-PASSENGER FEEDERLINER
Two Alvis Leonides 520 h.p. 9-cyl radials ; D.H. 9ft. c.s. airscrews

Span	54ft (17.06 m)
Length	42ft 10in (13.06 m)
Height	16ft 1in (4.9 m)
Gross wing area	363 sq ft (33.91 sq m)
Wing loading	29.2 lb/sq ft (142.6 kg/m)
Track	16ft 6in (5.03 m)
Tare weight	7,397 lb (3,355 kg)
Max t.o. and landing weight	10,650 lb (4,830 kg)
Max speed at 5,000ft	225 m.p.h. (362 km/hr)
Normal cont. cruising (46 per cent t.o. power, 30 gal/hr)	168 m.p.h. (270 km/hr)
Still-air range at above conditions	594 miles (956 km)
Max range, still air, (173 gall	1,060 miles) 1,706 km)
Take-off to clear 50ft at S.L.	810 yards (741 m)
Rate of climb, S.L.	1,115 ft/min (5.67 m/sec)
Service ceiling	23,400ft (7,140 m)
Take-off to clear 50ft, one engine cutting	1,210 yards (1,106 m)
Single-engine ceiling	12,000ft (3,660 m)

KING'S CUP PINPOINTS

A Pilot's Impressions of the Landmarks on the Wolverhampton Circuit

IT is now only a little over five weeks to the King's Cup Race, which, under the new scheme of allocating the National Air Races to various clubs, will be organized for the R.Ae.C. by Wolverhampton Aero Club and flown from the local airport on Saturday, June 17th. (On the following day the Goodyear Trophy Race takes place.) As listed on page 545 last week, there are 42 King's Cup entries, the highest total since 1934.

In these pages we give some detailed information about the cross-country course—information which, we hope, will be of assistance to competitors.

Grass surfaced, the airfield offers take-off runs of 3,390ft (N.-S.), 3,090ft (N.E.-S.W.), 2,940ft (E.-W.) and 2,700ft (S.E.-N.W.). The signals area is located in front of the new control-tower, in which the racing officials and commentators are likely to be housed, while the present club-house and surrounding area will probably be fenced-off to make a members' enclosure. Details of the public-enclosure arrangements and prices will shortly be announced.

The race is open to any type of British or Commonwealth aircraft of over 130 m.p.h. maximum speed (s.l.) and of all-up weight not exceeding 4,500 kg (9,921 lb) at take-off. Machines are handicapped on their estimated full-throttle performance.

Extending northward from Wolverhampton towards Stoke-on-Trent, the 100 km (62.13 miles) course is roughly diamond-shaped and will be lapped anti-clockwise three times, making a total distance of 300 km (186.39 miles). It must be flown at 800ft indicated, and a point that will be stressed at briefing this year is that aircraft must maintain at least 200ft when turning on the four pylons.

A member of the staff of *Flight* recently flew round the circuit in order to obtain some idea of the standard of navigation that will be required. If visibility is at all restricted, that standard will have to be quite high. The second leg, in particular, is singularly devoid of good landmarks and, since competitors will be only some 200ft above high ground, close attention will have to be paid to accurate pinpointing.

First Leg (17.76 miles).—About four miles after one has set course (o° 38° T) from Wolverhampton the track crosses the distinctively straight Watling Street at a point about a mile east of a triangular reservoir; over the nose of the aircraft the highest point on the entire course (wooded ground) appears prominently, while near the village of Hatherton two slag-heaps stand out like pyramids, to be followed shortly afterwards by two high radio-masts.

Approximately half-way along the leg, the large village of Hednesford provides an easily recognizable pinpoint under the starboard wing-tip, and then the pilot finds himself over the wooded high ground mentioned above. His next check is the junction of rail and river approximately a mile north-west of the village of Rugeley; then, from a point where two small rivers appear to cross each other, a main road leads straight to the disused airfield of Abbot's Bromley, where the pylon is to be located on the highest of the buildings on the south side of the airfield. The field itself is not too easily recognizable, but the main road comes to a T-junction at the airfield boundary.

Second Leg (13.37 miles).—Turning on to 320° T brings one on to the second and trickiest leg, over high, rolling country with few distinctive landmarks. Four miles along the leg one crosses a single-track railway running alongside a road, and at this position the black runways of the ex-R.A.F. field at Hixon should stand out well just off the port wing-tip. It is important to mark this check carefully, for over the next ten miles there is very little to see, though the Uttoxeter-Meir railway line, about three miles to starboard and gradually converging, should prevent the competitor from wandering off to the right of his track.

In maintaining a steady 800ft indicated, aircraft will be flying only about 200ft above the ground, so that a high ridge hides the next turning-point, Meir, until it is almost under the nose. If an accurate track has been maintained, two large kilns should come up "on the port bow"; should they tend to remain almost ahead a check should be made to starboard upon the position of the road leading to Meir village.

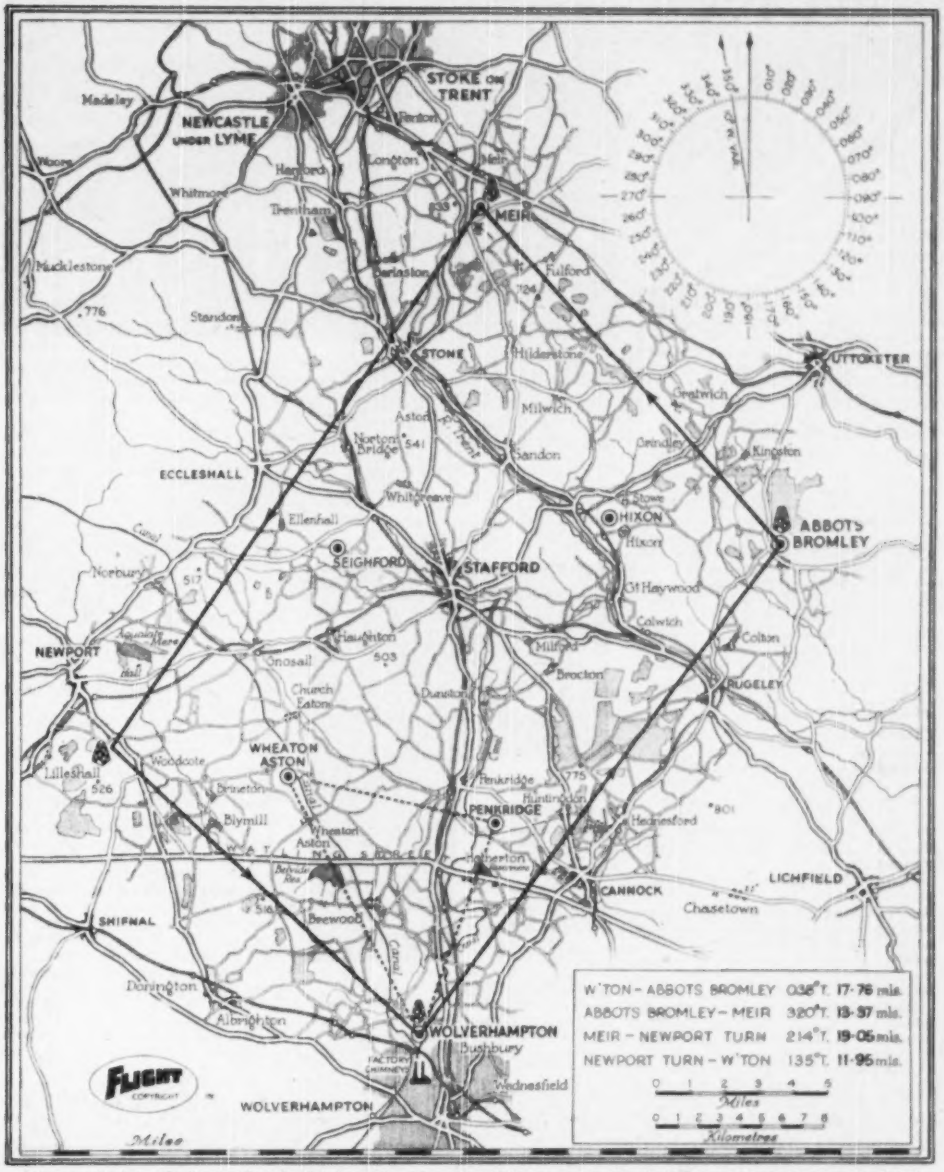
The airfield, which lies to the north of a triangular road junction and has one short tarmac runway, is used as a gliding school, so one or two gliders may be seen.

Third Leg (19.05 miles).—The turn is a sharp one on to 214° T, and almost immediately the new track brings the two large kilns at Barlaston nearly under the starboard wing-tip. This leg is a comparatively simple one to commence, crossing as it does slightly to the right of the little town of Stone with its triangular rail junction. After Stone the ground falls away quickly and part of a large built-up encampment (previously a bomb dump) passes under the starboard wing-tip; a single-track railway running into the site is not marked on the flying maps.

At the half-way point the former R.A.F. airfield at Seighford, with three quite serviceable runways, makes a good landmark on the port wing-tip, and after another mile or so one should be able to pick up a large oval reservoir with a mansion on its south bank. The track passes about half a mile from the eastern tip of the oval. Almost dead ahead, incidentally, in the far distance, stands a solitary, distinctively shaped hill—the 1,335ft Wrekin.

By crossing the railway just after it bends towards Newport and keeping the aircraft lined up on two prominent woods dead ahead, one should come upon the field containing the Newport-turn pylon; it lies immediately to the south of a junction of a minor road with the Newport-Wolverhampton road and has

QUICK QUADRILATERAL: KING'S CUP COURSE IN DETAIL



This specially drawn *Flight* map (¼ in : 1 mile) shows the topography of the course; the Goodyear Trophy circuit (dotted) is included.

extensive farm buildings ranged on its southern boundary.

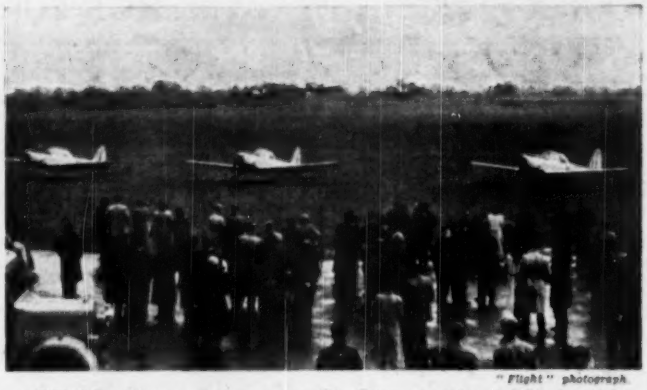
Fourth Leg (11·95 miles).—Turning (135° T) on to the final stretch, one passes almost over a small lake set in a wood, crosses Watling Street at an angle and, 3½ miles farther on, encounters a larger, parachute-shaped lake just to starboard. Two high chimneys, well known to many pilots, should now show up almost dead ahead and the straight section of the canal bounding Wolverhampton Airport will form a guide to the run-in (flying maps do not show this short, straight section). There may also be yellow-painted Wellington Trainers on the tarmac of the Boulton Paul factory, and they will form an additional check.

On the final lap pilots should aim to the left of the factory to get a clear run-in, almost parallel to the canal, over the finishing-line. The line will be marked by mounting the existing wind-sock on a 50ft tower some 400yd from the portable pylon.

There are half a dozen airfields available for forced landings around the course and they are all within three or four miles of the track.

E. A. G. R.

HERE and THERE



"Flight" photograph.

RESERVISTS' RALLY: Formation take-off by Chipmunks of No. 22 R.F.S. during the Cambridge "At Home" reported on page 598 of this issue. Twenty-three of the new trainers are now in service at Cambridge with the R.F.S. and University Air Squadron.

London-Khartoum

SUBJECT to confirmation, a Curtiss Commando of King Farouk's personal flight has set up a non-stop point-to-point record between London and Khartoum. Piloted by A.Cdre. Hassan Akef, it covered the 3,073 miles at an average speed of 180 m.p.h. The Commando, which took off from London Airport on May 1st, carried a crew of six and 2,800 gallons of fuel (twice normal load).

Westland v. Whale

MR. JOHN FEARN of Westland Aircraft, Ltd., has recently returned from Lisbon, which he visited in connection with experiments in the spotting and killing of whales from a Westland S-51 helicopter. A Mr. Reis of Lisbon owns a whaling factory in Portugal and whaling-boats which operate off the Portuguese coast, and the helicopter has been placed at his disposal for the tests. Those who have read Mr. John Grierson's book *Air Whaler* will recall that the author considered helicopters to be very nearly ideal craft for spotting and killing.

Cometic Progress

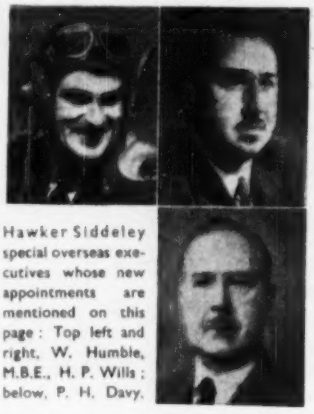
THE R.Ae.C. announces homologation of the de Havilland Comet's London-Copenhagen record flights on March 21st at speeds of 730.60 km/hr (454.03 m.p.h.) and 671.04 km/hr (416.95 m.p.h.) for the outward and homeward journeys respectively. The pilot, of course, was Mr. John Cunningham.

On April 30th, continuing its tropical trials, the Comet flew from Nairobi to Khartoum in 3 hr 10 min, this representing a speed of 420 m.p.h. for the distance of about 1,300 miles. The aircraft is at present making test flights from Khartoum, and is due to return to Hatfield this week-end.

As reported on p. 578, experiments in flight-refuelling the Comet are to take place when the necessary equipment has been installed.

Group Executives

THREE Group regional executives, for South and Central America, the Near East and Pakistan, and India and the Far East, have been appointed by the Hawker Siddeley Group. The respective posts will be filled by Mr. W. Humble, M.B.E., previously sales manager for Hawker Aircraft; Mr. H. P. Wills, formerly sales manager of Armstrong Siddeley Motors; and Mr. P. H. Davy, who was Deputy Director of Civil Aviation, India. Although the Group will maintain its existing selling organization all over the world, each of the new executives will be the senior Group official in his area.



Hawker Siddeley special overseas executives whose new appointments are mentioned on this page: Top left and right, W. Humble, M.B.E., H. P. Wills; below, P. H. Davy.

The Garden Party

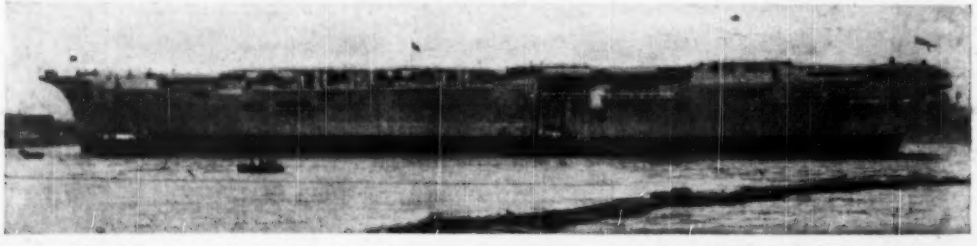
ONE of the highlights of the aviation year — the Royal Aeronautical Society's Garden Party—will occur next Sunday at White Waltham.

A varied flying programme has been arranged, and the French Fouga Cyclone jet-powered light aircraft—to name the most unconventional of the machines to be demonstrated — will form an extreme contrast to the historic Blériot and Deperdussin machines also appearing. Admission to the Garden Party is by ticket only.

More Powerful Stratojet

THE type designation YB-56 has been applied to a new four-jet version of the Boeing Stratojet bomber. The present production Stratojet, the B-47, is powered by six General Electric J-47 units, each of 5,200 lb thrust, installed in underwing "pods." In the new version, four Allison J-35-A23 turbojets will give an output of 9,700 lb each.

News also comes from America of a novel application for an earlier type of J-35, two of which have been installed in the Hughes XH-17 cargo helicopter. These units were modified by removal of a number of compressor stages and a



FOURTH OF HER NAME: On May 3rd H.M.S. *Ark Royal* was launched at Cammell Laird's Birkenhead yard by Her Majesty the Queen. Described by the First Lord of the Admiralty as the most up-to-date aircraft carrier in the world, *Ark Royal* is the fourth ship of her name. She is seen afloat, with slipway shores massed in the foreground. A fly-past by Naval aircraft marked the occasion.

HAWKER

CHARACTERISTICS

Amongst the features of all Hawker fighters are good all-round performance, long range and manœuvrability —characteristics which are built into the P.1052 interceptor.

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WOLVERHAMPTON

HERE AND THERE . . .

reduction in the amount of air passing through the combustion chambers to the turbine. Most of the air from the compressor is used to drive the rotors by tip-jet effect.

No Sale

BRITISH pressure is reported to have prevented the sale to Israel of jet aircraft (presumably fighters) by a "West European country." The same source claims that Britain has persuaded the United States not to sell arms to Israel.

Russian Canberra?

"A NEW-MODEL straight-wing, twin-jet light bomber which roared over Moscow's Red Square . . . impressed air attachés of foreign embassies. It was estimated to have flown at 600 m.p.h."—From a Moscow report on the Soviet Air Force's May Day parade.

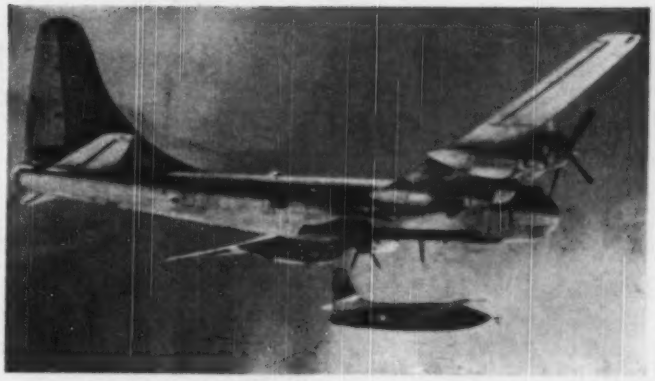
Princess for N.Z. Race

IN Wellington on May 1st, Capt. E. D. Clarke, managing director of Saunders-Roe, Ltd., announced that his company's Princess flying-boat may be entered for the 1953 air race between London and Christchurch, New Zealand. Each powered by ten Bristol Proteus turbo-props, three Princesses are being built at Cowes for B.O.A.C. The latest target date for launching Princess No. 1 has been quoted as September, 1951.

Payment for Progress

IN the House of Commons on April 24th, A. Cdre. A. V. Harvey (Con., Macclesfield) asked the Minister of Supply what sum had been paid by the U.S.A. to Power Jets (Research and Development), Ltd., for the use of gas-turbine designs and patents as from September, 1945. Learning that no payment had been made, he urged that the matter be taken up.

Mr. Freeman, Parliamentary Secretary to the Minister of Supply, then revealed that the question had been taken up "with the greatest vigour." He asked A. Cdre. Harvey not to press the matter, as negotiations with the U.S. Government were in progress which, it was hoped, would have a satisfactory outcome.



DROPPING THE PILOT: First picture to show the supersonic Bell X-1 in the act of "detaching" from the parent B-50 employed to lift it to high altitude (a B-29 was used in the earlier stages of the X-1 flight test programme). The rocket-powered X-1, which made the world's first supersonic flight in October, 1947, is shortly to be installed in the Smithsonian Museum. More advanced designs, with swept-back and delta-form wings, will carry on the U.S. high-speed research programme.

NEWS IN BRIEF

A PARTY from the Imperial Defence College, which included A. Cdre. H. L. Patch, C.B.E., recently visited the Holmforth (Yorks) mills of T. and J. Tinker, Ltd., who specialize in aircraft upholstery and—at the other end of the Service scale—infantry puttees.

* * *

Flying people interested in the prospect of "a really lazy holiday with magnificent bathing and fishing" may be interested to hear that such attractions are offered by the Grand Hotel, Alderney, C.I.—and more interested to hear that it is being run by F/L. Tommy Rose, of record-breaking fame.

* * *

Vokes, Ltd., of Guildford, whose filtration and silencing equipment is already being manufactured in Australia, France and America, announce the inauguration of a subsidiary company—Vokes (Canada), Ltd.—with headquarters in Toronto and Mr. J. Parkinson (formerly sales manager in England) in charge. It is also announced that the new company will handle Canadian sales of the mechanical seals made by Flexibox, Ltd.

Mr. F. W. Kendrick, until recently Dunlop's acting sales manager for tyres in South Africa, has been appointed Dunlop tyre export manager in London.

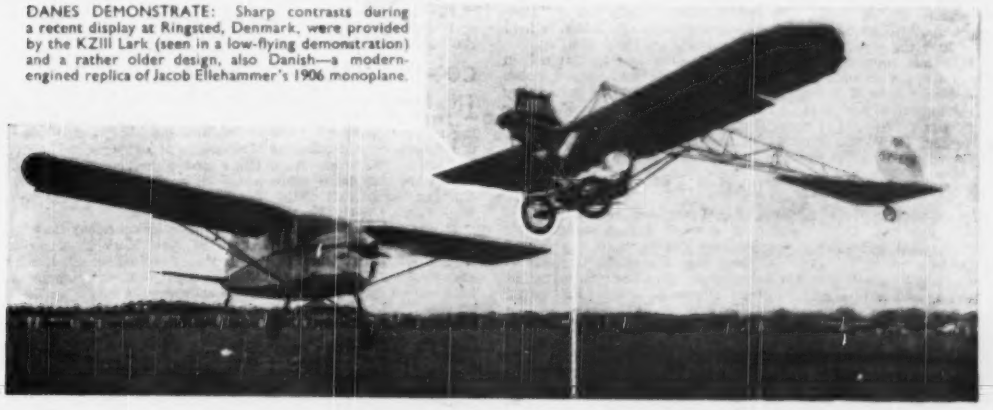
* * *

Mr. W. A. Weaver, M.Inst.B.E., chairman and managing director of the Coventry Victor Motor Co., Ltd., is shortly to visit Canada, accompanied by his son, Mr. A. N. Weaver, who is technical sales director.

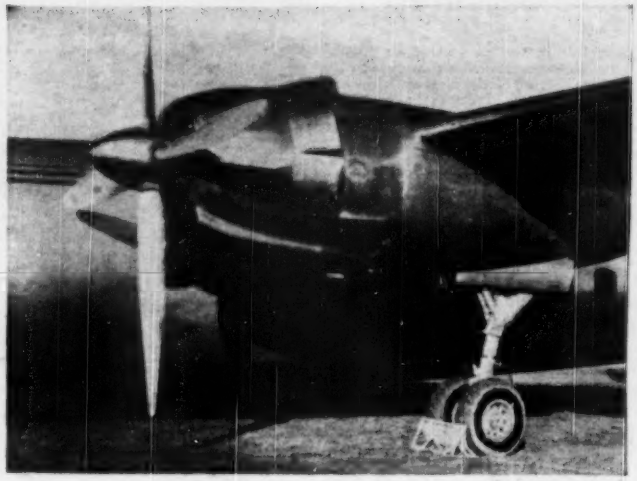
* * *

Dr. R. Hargreaves has lately joined Tiltman Langley Laboratories, Ltd., Redhill, as chief metallurgist. Dr. Hargreaves, who has specialized in high-temperature corrosion, took his B.A. degree in 1937, was awarded a D.S.I.R. grant for research training in metallurgy, and in 1940 received the Ph.D. degree. He was metallurgist for the aviation department of Shell Refining and Marketing Co., Ltd., from 1940 to 1945. He was employed at Ricardo's Laboratories and Thornton Aero Engine Laboratory. From 1945 onwards he was technical manager of the Aero Piston Ring Co., Ltd., Leeds.

DANES DEMONSTRATE: Sharp contrasts during a recent display at Ringsted, Denmark, were provided by the KZIII Lark (seen in a low-flying demonstration) and a rather older design, also Danish—a modern-engined replica of Jacob Ellehammer's 1906 monoplane.



CIVIL AVIATION NEWS



GIVING IT AIR : The first prototype Airspeed Ambassador is flying with a Bristol Centaurus 661 to port and a 631 to starboard. The latest cowling arrangements for the 661—which, of course, will be fitted to the production aircraft—are seen in this photograph and described "Cooler Cowlings" in an item below.

B.E.A.'s BETTER RESULTS

A PRELIMINARY estimate of B.E.A.'s financial results for 1949, given by Lord Douglas of Kirtleside, the Corporation's chairman, shows that the deficit for that year was reduced to approximately £1,450,000, a decrease of 50 per cent on the previous year's figure. The chairman stated that although he had hoped to reduce the deficit to £1,300,000, devaluation had cost a further £180,000 by increasing the price of fuel, spares and overseas station maintenance.

This year, by increasing the total flying hours by 21 per cent and achieving a 35 per cent increase in revenue, he hoped that at least a 17 per cent reduction of the 1949 deficit would be possible. The total increased costs due to devaluation would amount to £449,000 during the 1949-50 financial year. In addition, Lord Douglas said, B.E.A. might also have to contend with a fuel tax on internal services.

One of the more favourable results of devaluation, however, had been the increased bookings on Continental services and Lord Douglas thought that, provided no further unexpected financial blows were received, the increased traffic would even enable B.E.A. to improve on the estimated figure for its operating deficit in the current financial year.

EXPLOSIVE EXIT?

A RECENT announcement by the Department of Scientific and Industrial Research indicates that a means of using an explosive charge rather than an axe to provide an exit for the occupants of crashed aircraft is now under development. The M.C.A. is understood to be interested in the idea.

As is well known, in rescue work it is often difficult to break through the fuselage quickly enough to release passengers or crew. The new device would incorporate a "line-charge," about double the thickness of a pencil, which is held against the structure by a mechanically operated arm.

It has been demonstrated that unless people trapped in aircraft are actually leaning against the particular panel which is blown open it is unlikely that anyone would be injured by the explosion and that in any case such injuries would not be serious. The idea of the "shaped line-charge" was developed by Dr. E. W. G. Phillips, of the Forest Products Research Board, who during the war conducted a survey of crash fires.

U.S. AIRLINES' YEAR

ACCORDING to the U.S. Air Transport Association, the American airline industry as a whole made a record profit of $45,000,000 (about £16,000,000) during 1949, an overall increase of 30 per cent on the figure for 1948. A total of 16,420,132 passengers was flown over 8,842,805,000 passenger-miles, and a new safety record of one passenger fatality for every 100,000,000 passenger-miles was established.

Passenger traffic contributed 81.99 per cent of the total incomes of regular U.S. operators while mail accounted for 10.08 per cent and cargo 5.86 per cent. The Association states that passenger fares are now down to a level "consistent with profitable operations" and points out that cargo revenues have shown a spectacular increase since 1946. Last year the 95,000,000 ton-miles of cargo flown by all companies at an average rate of 19¼ cents (about 1s 4½d) per ton-mile produced more than $18,000,000 (£6,400,000) in revenue.

One of the primary factors which contributed to the industry's favourable position last year was undoubtedly the "air-coach" experiment which, in the words of Mr. Joseph O'Connell, chairman of the C.A.B., "although originally accepted with some misgivings by the Government, has proved generally successful." He said that the future of "coach" services depended entirely on the answers to such questions as whether they attracted new business or simply diverted it from existing first-class services, and whether they would pay their own way. He gave a warning, however, that the C.A.B. regarded price-cutting somewhat cautiously, and pointed out the dangers of any violent fare reduction which might follow the present limited cut rates.

COOLER COWLINGS

THE power plants for the production Ambassadors are Bristol Centaurus 661's, around which the Airspeed company have assembled four semi-independent panels to form the petal cowling seen in the photograph above. Wide-chord gills are fitted aft of the inside ring and ahead of the shoulder cowl in place of the venturi-type inward-opening louvres of earlier installations. Airspeed state that practical experience has shown that the internal air intake is not altogether satisfactory, either from the engine-efficiency or oil-cooling point of view, and thus a direct intake, bifurcated to provide both engine and oil cooling air, is now provided.

A shoulder cowl of stainless steel protects the accessories behind the engine and its inside ring. As before, this ring carries the gases to stacks which discharge over the wing. The stub stacks are cowled to give a venturi effect and thus assist the cooling-air flow through the engine.

COMET FLIGHT REFUELLING?

IN connection with Mr. C. H. Latimer-Needham's R.Ae.S. paper (summarized on pages 588-589 of this issue) discussing the possibilities of flight-refuelling the D.H. Comet, it is of interest to record that on Wednesday of last week the B.B.C. put out a news story to the effect that when the present flight tests were completed there would be a series of trials to find whether the aircraft could operate a non-stop London to New York service with the aid of aerial refuelling.

It was the opinion of the B.B.C. air correspondent that the Comet could carry 48 passengers to New York in seven or eight hours, and back again in six, if refuelled off Ireland and Newfoundland on the outward flight, and off Newfoundland on the homeward trip. The experiments would be based on the direct-contact system used to refuel jet fighters.

At first reluctant to comment on the statement, the de Havilland Aircraft Co., Ltd., later told *Flight* that it was basically correct, though it would be wrong to assume that the experiments were imminent. It would, they said, be several months before the first steps were taken to install the

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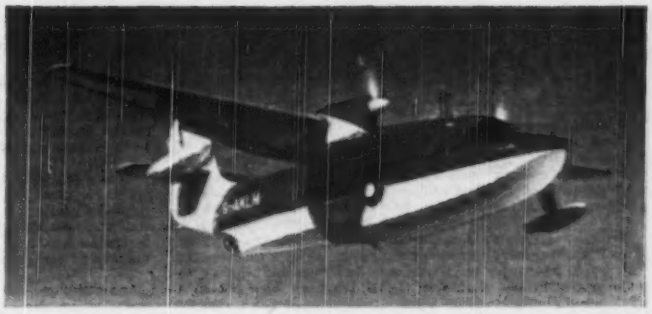
CIVIL AVIATION NEWS

necessary equipment on the aircraft.

It may be surmised that tests will be made to determine the most satisfactory refuelling technique. In particular it must be decided whether the Comet or the tanker should carry the cone. There are arguments for each case.

SEALAND TOUR

ON May 5th a Short Sealand amphibian, powered by two de Havilland Gipsy Queen engines, cleared Customs at Northolt and departed on a demonstration tour of Portugal, Spain and the Canary Islands. The pilot was Mr. G. Moulton-Barrett and the crew consisted of J. C. Corlett, assistant chief works inspector at Short Brothers and Harland, Ltd., and N. F. Lovett, of the firm's sales department. The Sealand was due to demonstrate in Madrid on the 7th, in Gibraltar on the 9th, and in Tangier on the 10th. Other demonstrations are planned at Las Palmas, Teneriffe, Lisbon, Averio, San Remo, Toulon, Lyons, Paris and Amsterdam.



SMART OUTFIT: The fashionably finished Short Sealand amphibian (two D.H. Gipsy Queens) which, as recorded on this page, has departed on a demonstration tour of Portugal, Spain and the Canary Islands. The Sealand carries 5 to 8 passengers.

B.I.F. HELICOPTER SERVICE

ROTOR STATIONS, LTD., and Westland Aircraft, Ltd., with the agreement of B.E.A., have arranged a twice-daily two-way helicopter service between London and Castle Bromwich for the benefit of visitors attending the British Industries Fair. The aircraft is, of course, a Yeovil-built Leonides-powered Westland Sikorsky S-51, and the terminals are the Harrods sports ground at Barnes—serving Earls Court and Olympia—and the Castle Bromwich airfield, alongside which the Birmingham section of the Fair is housed.

As the B.E.A. Cardiff-Liverpool service is not due to start until June 1st, this all-British enterprise is the first scheduled inter-city helicopter service in the world. The flight time is provisionally scheduled as 75 min each way, with a 15 min turn-round. The S-51 is being flown by Mr. K. M. Reed, a Westland pilot, and three passengers can be carried; fares are £7 10s single and £10 return.

Bookings can be made through the Olympia office of Rotor Stations, Ltd. (1, Maclise Road, London, W.14—Shepherds Bush 5385), or at the Overseas Buyers' Clubs at the three sections of the Fair.

I.A.T.A. TARIFFS APPEAR

THE first international consolidated tariffs in the history of transport and communications were simultaneously filed on May 1st at Washington and Ottawa by I.A.T.A. on behalf of 25 scheduled airlines operating in all parts of the world. They will become effective on June 1st.

The two tariff documents cover rules for the carriage of cargo and provide conversion tables which make possible the quick computation of rates in different currencies.

Sir William P. Hildred, I.A.T.A.'s Director-General, said that the new tariffs would eliminate the necessity for large numbers of individual tariffs and manuals now published by the airlines. Legal, traffic and tariffs experts of the airlines have spent almost four years in bringing the consolidated tariffs to publication, Sir William added. They are based on the standard I.A.T.A. Conditions of Carriage, which are now adopted as recommended practices by member-companies.

The Cargo Rules Tariff will constitute the official cargo rules of each participating carrier and will govern the application of separate tariffs which those carriers may publish. It consolidates and sets up in a single document the rights and obligations of the carriers and users of air cargo. Included in the tariff is detailed information as to the execution of air waybills; kind and type of goods which will not be accepted for shipment; condition, packing and marking of goods; basis for charges; rights of consignees; rules for pick-up and delivery; city terminal services; and forwarding and the like.

The Unit Conversion Tariff tables provide coefficients by which charges expressed in standard units can be quickly multiplied to provide exact totals in various currencies. On the basis of present rates of exchange, the single unit is worth 10 cents U.S., 11 cents Canadian and 0.741285 shillings in both sterling and Irish currency.

Both tariffs will be kept up to date by a revision service. Copies of the Cargo Rules Tariff will be made available to anyone upon request at an annual subscription price of $1.50 (U.S.), which will also cover copies of the unit conversion tariff without further charge.

MARATHON HOMECOMING

WITH more than 35,000 miles flying behind her, the Handley Page Marathon G-ALUB returned on May 2nd from a 15-week demonstration tour of New Zealand, Australia, India, Pakistan, the Middle East, North Africa and Europe. G/C. A. F. Bandidt, who headed the mission (Mr. Hugh Kendall was the pilot), reports great satisfaction with the behaviour of the aircraft and the de Havilland Gipsy Queen engines under all manner of adverse tropical conditions. The same set of Palmer tyres was used throughout. Interest among airline operators was, to say the least, encouraging, and many advanced their own ideas on matters of layout and equipment.

The Marathon's route was: Nice, Brindisi, Athens, Nicosia, Bagdad, Bahrein, Sharja, Karachi, Calcutta, Rangoon, Singapore, Koepang, Sydney, North and South Islands of New Zealand, Sydney, New Guinea, Sydney, Melbourne, Adelaide, Perth, Broome, thence returning over the same route except for demonstrations in Egypt, Malta and France.

BREVITIES

AIR France has asked the Mexican Government for permission to establish a route between Paris and Mexico City. Services will start, it is understood, as soon as authority is obtained and suitable equipment ready.

* * *

Silverstone airfield where, next Saturday, May 13th, the Grand Prix d'Europe motor race is to be run before the King and Queen will, we understand, not be available for use by aircraft on that occasion.

* * *

S.A.S. has started a new service to link Copenhagen and Lydda, Israel, in 13 hours. Aircraft leave Copenhagen every Thursday, flying to Lydda via Munich and Istanbul. The service connects with other S.A.S. services from Scandinavia and the United States, making it possible to fly from New York to Lydda via Copenhagen in 30 hours.

F.A.M.A. introduced DC-6s on their London to Buenos Aires service on April 18th, equipped for 40 passengers and a considerable load of freight. The journey-time has been reduced to 34 hr 10 min, services leaving London at 1100 hr G.M.T. on Tuesdays and arriving at Buenos Aires at 2010 hr next day; the return service leaves at 1100hr on Fridays and arrives in London at 2100 hr on Saturdays. The route (via Lisbon, Dakar, Natal and Rio de Janeiro) remains unchanged.

* * *

B.O.A.C. have reduced passenger fares on sectors of their Caribbean and South American west coast routes. As a result, through fares from London and other European cities to Panama and Lima (Peru) and to Santiago (Chile)—via the Caribbean—have also been reduced. The London to Panama fare, formerly £181 15s, is now £172 9s; and London to Lima, formerly £243 3s, is now £228 8s. The new fare between

CIVIL AVIATION NEWS . . .

Nassau and Santiago is 364 U.S. dollars (a reduction of $99), and between Kingston (Jamaica) and Lima $227 U.S. ($27 less).

* * *

Colonial Airlines claim a safety record with the completion of their 20th year of regular operation without a fatality or serious injury to a passenger or crew-member. During that period they have carried more than 1,205,000 passengers over their network of 3,182 miles from New York and Washington north to Montreal and Ottawa and south to Bermuda.

* * *

M.C.A. *Information Circular No.* 39/1950 points out that, since licensing provisions under the South African Air Services Act, 1949, have now been enforced, any operator wishing to make non-scheduled flights to the Union must now obtain a licence and certificate from the South African National Transport Commission. Information about the procedure is obtainable from the M.C.A. Information Service, Pinner, Middlesex.

* * *

The Australian Minister for Air has announced that an interim arrangement has been concluded between the Australian and Philippine Governments which will permit Q.E.A. to carry traffic between Australia and Manilla on one of its twice-weekly services to Japan. This agreement, which will be effective for three months, also provides for an airline nominated by the Philippine Government to be granted similar rights to Australia.

The Fairchild operated by the Women's Junior Air Corps is to be fitted with radio made available by the Plessey Co., Ltd.; Airwork, Ltd., are co-operating in the installation.

* * *

About 28,900 passengers had flown on P.A.A. Stratocruisers by the end (April 15th) of the first year of Atlantic service with this type. About 23,000 of these passengers were carried on the 600-odd transatlantic flights to London and Frankfurt, while the remainder were on the Bermuda route.

* * *

Cowes (I.o.W.) Airport, including Cowes Aero Club, is now under the managing directorship of Capt. Randall Ward, Mr. Russell Gunton having relinquished his interests in the organization. The company is being re-formed under the title of Somerton Airways (1950), Ltd., and Mr. R. Turlington retains his post as general manager; Capt. J. W. Jessop is chief pilot.

* * *

According to a recent announcement by the Portuguese representative on the I.C.A.O. council in Montreal, airline passengers wishing to spend a few days in Portugal will no longer need a visa. The relaxation means that transit passengers may stay four days without visas, and may have the period extended by a further six days on request.

* * *

During March, 2,071 fare-paying passengers travelled in Doves and Wayfarers on the internal network of West African Airways Corporation, which connects with the B.O.A.C. West Africa/U.K. services. This is a record total for any one month since West African Airways Corporation started operations in October, 1947.

GLIDING NEWS

IT is unfortunate that, just when gliding clubs are looking forward to financial stability, launching and retrieving charges will have to be raised to cover the recently increased petrol tax. On the other hand, the increased charges for power flying may bring more supporters to gliding clubs since, although launching and retrieving costs must rise, the increase in charges will not be so great as those the power clubs must make. In gliding clubs, the increased charges will probably be reflected in a smaller demand for aero-towing and a greater one for cheaper launches such as the bungey.

* * *

Congratulations to F/L. Peter Mallett, recently returned from a soaring holiday in France. On the sixth day of his stay at Saint Auban gliding centre, F/L. Mallett contacted the standing wave and climbed to 14,000 ft. Subject to confirmation, this altitude completes his Gold Badge, of which he will probably become the seventh holder in the United Kingdom.

At Saint Auban was M. Marmol, who is understood to have completed his Gold Badge height at the same time.

* * *

Gliding and soaring are receiving a great deal of support in France, particularly from official sources. The French Air Force, the F.A.I. and other organizations have officially agreed on the value of gliding for Air Force personnel, and on the creation of "military sections" within established gliding clubs convenient to Air Force units. These sections operate under club rules, and are supervised by the local unit sports officer. Mid-week flying by Air Force personnel is encouraged, and all gliding and soaring with a military section is considered as duty flying, complete with flying pay and other benefits.

Club instructors train military members, and provision is made for such members to be trained to instructor standard at S.A.S. centres. The club concerned has to carry insurance against damage to equipment, third-party claims, and so forth, but Air Force unit commanders are instructed to assist in the servicing of gliders and equipment, salvaging gliders and making minor repairs. Civilian clubs operating this scheme receive a generous free ration of Air Force petrol for launching, aero-towing and similar purposes. In addition, there is, of course, the additional income which clubs are bound to receive as a result of the establishment of a military section within their organization.

In France, therefore, Service gliding is taking place within the framework of established civilian clubs, while in this country it is being developed as a separate self-help organization under the auspices of the R.A.F. Gliding and Soaring Association.

* * *

Mr. Helle Lasch, of South Africa, has recently made two very creditable and interesting flights. In February of this year, flying an Air 100, he cast off whilst on aero-tow retrieve from the Free State to Johannesburg. Soon after release, under a thunderstorm, he entered the cloud and had smooth lift up to 16,000 ft at 10 m/sec. At 18,000 ft, lift had increased to 20 m/sec, but rain, hail, ice and increasing turbulence were encountered in the upper levels.

With 25,300 ft on the altimeter, Mr. Lasch set course due north and emerged from the down-wind edge of the storm at 10,000 ft with his aircraft heavily iced. Unfortunately, although a greater height was shown on the altimeter, the barograph only registered up to 20,000 ft—one of those annoying circumstances well known to all sailplane pilots who attempt qualification or record flights. The previous South African record of 18,200 ft was held by Major Pierre Retief.

Soon after his record climb, Mr. Lasch flew 276 miles in 6¼ hours from Baragwanath to his declared goal of Estcourt—74 miles more than Mr. Werner Kunze's previous South African record. Mr. Lasch was released from an aero-tow launch at 11.45 hr and, ten minutes later, had circled to 9,000 ft. With a six-knot tail wind, good ground-speed was made. Developing cumulo-nimbus and many thermals enabled the pilot to arrive over Estcourt at 17.45 hr with 11,000 ft in hand. With this flight Mr. Lasch gained his Gold Badge, one Diamond, and the South African goal and distance records.

FORTHCOMING EVENTS

May	14.	R.Ae.S. Garden Party, White Waltham.
May	16.	Aero Golfing Society: *Flight* Cup Meeting, St. George's Hill.
May	19.	Bomber Command Night, Royal Albert Hall.
May	19-21.	Air Tour of Sicily.
May	20.	Northamptonshire Aero Club: "At Home."
May	20-21.	Yorkshire Aeroplane Club: International Rally, Sherburn-in-Elmet.
May	25.	R.Ae.S.: 38th Wilbur Wright Memorial Lecture, by Sir Richard Fairey, M.B.E.
May	27-29.	Champegny Rally, Epernay-Plivot.
May	27-28.	Bembridge and Sandown Aero Club: Rally.
May	28-29.	Ailes d'Azur Rally, Cannes.
May	29.	West London Aero Club: S.S.A.F.A. Display, White Waltham.
June	2-4.	Tyrol Rally, Innsbruck.
June	3.	Derby Aero Club: "At Home" and Display.
June	3-4.	"Routes of Anjou" Rally, Angers.
June	3-4.	Ultra Light Aircraft Association: Rally, Fairwood Common.
June	4.	F.A.I.: General Conference, Stockholm.
June	4.	Aero Club of Normandy: Aerobatic Competition.
June	4.	Ragosine Trophy Navigation Competition, Rearsby.
June	10.	Blackpool and Fylde Aero Club: "At Home."
June	10.	Darlington Flying Display.
June	10.	Yorkshire Aeroplane Club: International Rally, Sherburn-in-Elmet, Leeds.
June	10-25.	Brussels International Aeronautical Exhibition.
June	11.	Fête Aérienne d'Orly, Paris.
June	15-18.	Benelux Air Tour.
June	16.	Institute of Navigation: "A Survey Flight to South Africa," by J. L. Cowan; "Light-aircraft Navigation," by Michael Townsend.
June	16-19.	Aero Club de Roussillon: Perpignan Rally.
June	17-18.	Normandy Rally.
June	17.	Wolverhampton Aero Club: King's Cup Race.
June	18.	Wolverhampton Aero Club: Goodyear Trophy Race.
June	23.	Institute of Navigation: "Aeronautical Charts," by T. St. Barbe Freer.
June	24-26.	Le Touquet Rally.

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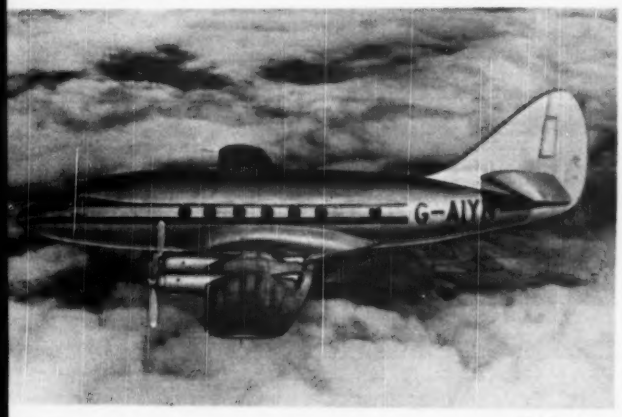

"Flight" photograph

With the Python, Mamba and Double Mamba now flying, the experience we are gaining is proving of great interest to the civil aircraft operator. Quiet and vibrationless in flight they give a smoothness which only a turbine provides. They are economical in operation, with plenty of reserve power for take-off and climb, and introduce an entirely new standard in air safety.

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- ★ Simplicity in servicing — negligible maintenance.
- ★ High power/weight ratio.
- ★ Good speed/range variation.
- ★ Efficiency maintained at all engine speeds and altitudes.
- ★ Remarkable quietness and absence of vibration.

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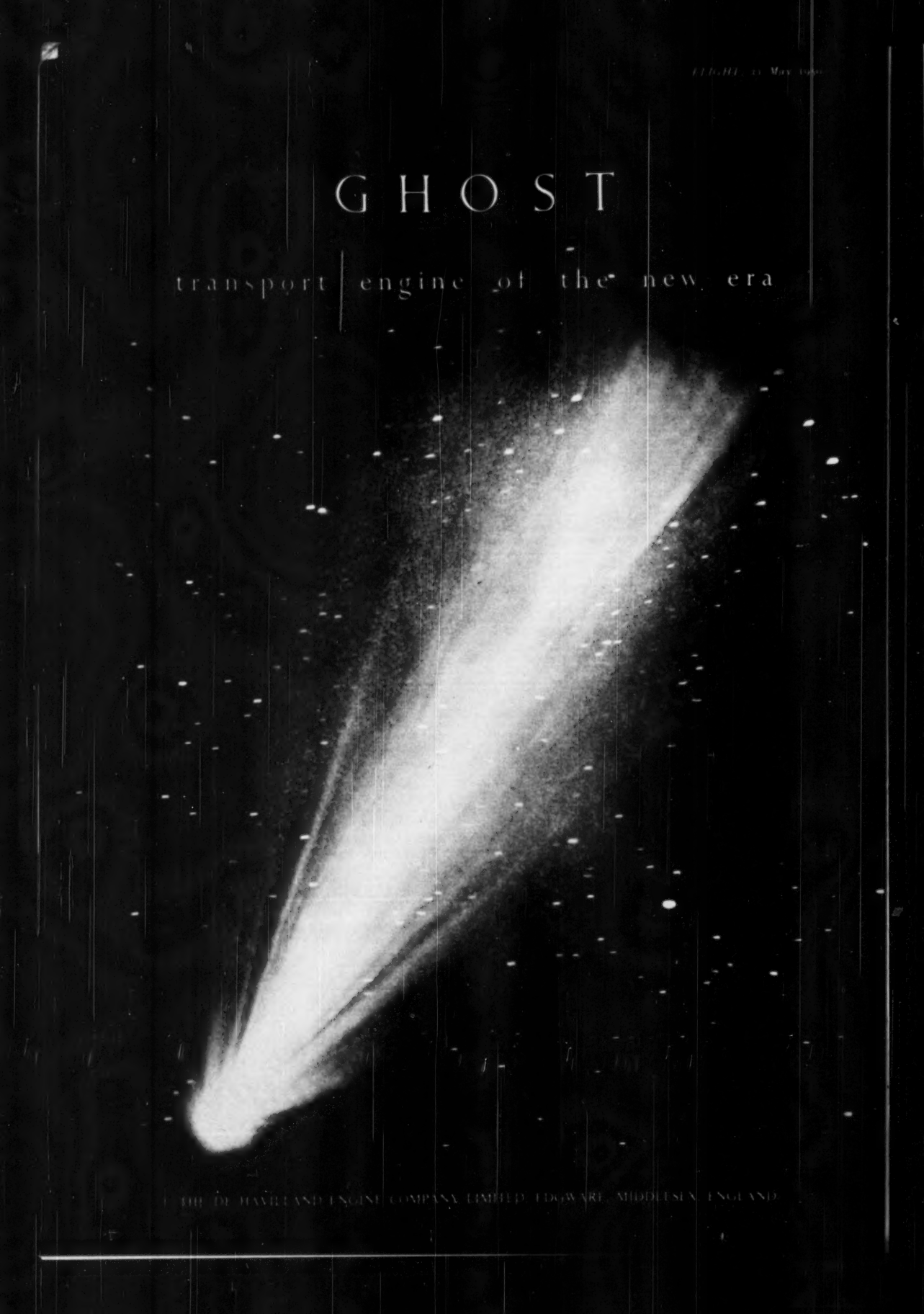

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For Coastal Command

New, and Dissimilar, Aspects of the Avro Shackleton G.R.1, Soon to Enter R.A.F. Service

Finished in the white and sea-grey colour scheme standardized for general-reconnaissance aircraft of R.A.F. Coastal Command, the third prototype of the Avro Shackleton G.R.1 (four Rolls-Royce Griffons) is seen while on a recent test-flight. The Shackleton is our largest military aircraft, measuring 120ft in span and having a gross wing area of 1,421 sq ft. Weight and performance data are restricted, but a detailed description of the type will be published in an early issue of *Flight*. Some other recent views appeared in the issue of April 27th.

UNITY IN THE AIR

A Gloster Meteor 7, standard jet trainer in three of the four Western Union air forces, is an appropriate background for this photograph — the first published—of the four-power Examining Squadron. From left to right, its members are: (standing) Commandant L. C. Girardon (France); Capt. C. Sipkes (Netherlands); S/L. P. M. Dobree-Bell, Commanding Officer (Britain); Capt. Y. J. Beek (Netherlands); Capt. P. Parent (France); Capt. L. F. Bastin (Belgium); F/L. E. C. Rideal, Adjutant (Britain). (Top) F/L. J. A. Long (Britain); Capt. M. De Smet (Belgium). "Flight" photograph.

Western Union Examining Squadron to Standardize Flying Training of Four Air Forces

HOWEVER close were the inter-Services associations between Britain and her wartime allies, the new Western Union Examining Squadron expresses international military co-operation to a degree probably unprecedented either in peace or war. The Squadron was formed, and is now based, in Britain, under a British commander; each year, however, responsibility for its upkeep will fall upon a different partner of Western Union. Thus, France, Belgium and the Netherlands will take turns with Britain in providing, annually, a new commander and a fresh base for the Squadron. The actual order of rotation has not yet been settled.

When the Examining Squadron begins operations on June 1st, it will assume the duties of inspecting and analyzing flying training methods in all four nations, and assisting instructional staffs to work to a common standard. The evolution of fine flying technique, and the reproduction of such technique in quantity—the obvious foundation on which the examiners must work—are the heritage of the R.A.F.'s Central Flying School; nowhere else is there a directly comparable establishment. Because such knowledge was available at C.F.S., now based at Little Rissington, Gloucestershire, and not on account of Britain's numerical pre-eminence in Western Europe, the Examining Squadron was born in this country.

In appreciating fully the aims of the Squadron and the way in which it will work, one must have some insight into the *modus operandi* of C.F.S.—the background of experience against which this truly international unit has been formed. In the words of an Air Ministry Order: "The tradition of organized flying instruction, which was born at Gosport in the days of the first world war, has grown with the passage of time, and is now a major factor influencing R.A.F. efficiency in peace and war. The C.F.S. is the guardian of that tradition, and is responsible for ensuring that it does not lag behind developments in operational flying."

To fulfil its obligations, C.F.S. works in two ways—instructing and examining. Members of the Flying Wing are charged with training flying instructors whose skill, knowledge and enthusiasm are passed on throughout the Air Force. Potential instructors are taught to master the art of teaching confidently and effectively both in the air and on the ground; and to fly accurately a wide range of aircraft, both training and operational. For many years, the precision of C.F.S. flying has set an international standard. When the Chief of the Air Staff spoke recently at the Royal Academy Banquet of the real beauty to be found in the work of the Services, he mentioned, as an instance, the scene of C.F.S. formation aerobatics against a summer sky. By the C.F.S. tradition, the art of flying and the efficiency of the R.A.F. are for ever inseparable.

Although a more recent institution, the Examining Wing bears a co-equal share of the School's responsibilities. Its duties are to inspect flying training in all commands of the R.A.F.; to examine and up-grade, where appropriate, flying instructors of category "B.1" and above. From the verbal and written reports of the Wing's members, the School is provided with a constant flow of current information on the problems and lessons of operational flying, and on the day-to-day instructional activities of its former graduates. In the established post-war aim of building an all-weather Air Force, the Examining Wing plays an important part; its members are responsible for assessing selected candidates from every station for appointment as instrument-rating examiners.

All-through schools, advanced flying schools, operational conversion units—and, by specific request of commands, operational squadrons—all receive periodic visits from the Examining Wing. Obviously, such visits could easily come to be regarded, by the stations visited, as annual inquisitions, intent only on finding fault and touching-off "rockets" from Group H.Q. Members of the Wing's three visiting teams, however, are well aware that criticism must be well-founded and essentially constructive; additionally, they work with a combined background of instructional and operational experience in all commands.

One team is exclusively responsible for inspecting Training Command and Reserve Command establishments. The composition of the other teams varies according to the activities of the station visited.

On arrival at a typical station, members of an examining team work out a tentative programme with the C.O. and his training staff, having consulted in advance the previous year's report and records of any pertinent occurrences, such as accidents, in the interim period. The first step is the examination of instructors—if possible, of every instructor on the station. An individual examination, when up-grading to "A" category is involved, can occupy all day, the morning usually being devoted to a ground test in the style of an informal quiz. Flying ability, studied first-hand in the air, is the first consideration in the four-point examination; ability to impart knowledge, the second point, touches on many aspects of an instructor's personality and bearing. Another consideration is the candidate's knowledge of the R.A.F. sequence of flying instruction. Here it should be noted that although the "patter" technique—whereby instructors taught every manœuvre or movement by pre-ordained phraseology—is now being completely eliminated, there is still a set sequence. The fourth point is technical knowledge, a subject embracing principles of flight, meteorology, instrument-flying, air-

traffic procedure and, of course, the aircraft themselves.

When instructors have been "checked out," the examiners fly with a cross-section of the establishment's pupils to assess standardization of training and test the judgment made of the various instructors' qualities. Sometimes, at the request of the training staff, the examiners investigate the faults of a particularly "difficult" pupil.

The remainder of the team's time is spent in inspecting ground-training facilities and analyzing the totals and personal distribution of hours flown on the station. After an inter-team discussion—which might produce evidence of incorrect procedures running through the entire unit, or, conversely, of a high general standard of instruction—there is a final conference between examiners and the staff. Various points (which might cover, for instance, asymmetric flying technique, cockpit checks or starting drill) are raised and discussed, with complete freedom of argument on either side. Finally, the team returns to Little Rissington to compile reports for the appropriate Group H.Q., the C.F.S. Commandant and the Examining Wing records.

Members of the Western Union Examining Squadron assembled in London on January 10th and shortly afterwards arrived at C.F.S. to begin a study of the Examining Wing's methods. Their intention, it must be stressed, is not merely to superimpose R.A.F. policy on the other three partner Air Forces; the Examining Wing is a proven, successful unit with experience too extensive to disregard.

Including the Commanding Officer, S/L P.M. Dobree-Bell, A.F.C., the Squadron consists of eight pilots (two representatives of each Western Union Air Force), together with a R.A.F. adjutant and a small administrative and technical staff. The C.O., a former graduate of the Central Flying School of Canada, has, in recent years, been assistant air attaché in Warsaw and senior tutor at the former Empire Flying School, Hullavington. His wartime experience includes command of a night-fighter squadron. Pilots were selected mainly on the basis of their ability as instructors, although all have operational experience, having flown in or alongside the wartime R.A.F. Since their arrival at C.F.S., the eight pilots have all been approved as instrument-rating examiners and have flown a varied and concentrated programme of 50 hours' flying on standard R.A.F. trainers—the Prentice, Chipmunk and Harvard.

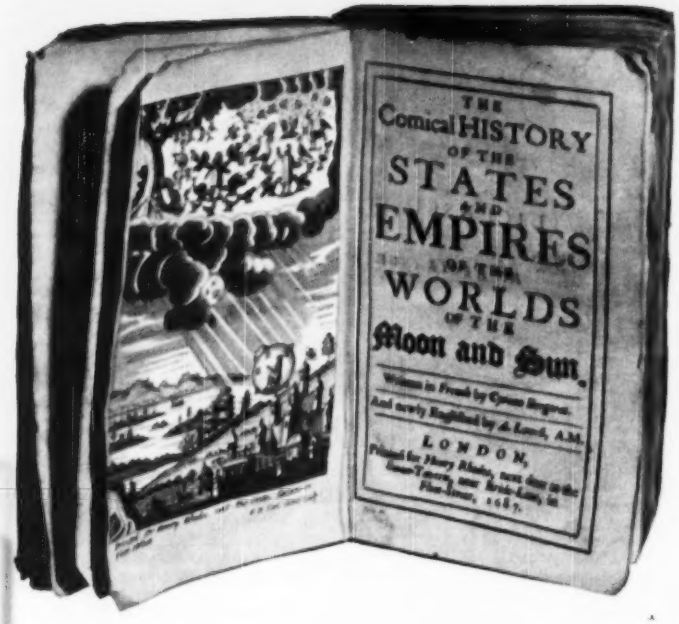
Early next month, using Anson communication aircraft, the Squadron will begin its inspection of Western Union establishments giving training up to "wings" standard. Its "diocese," incidentally, extends as far south as the French stations in Morocco. The examining pilots will make first-hand acquaintance with the types of aircraft and the training techniques employed, with the ultimate object of recommending an acceptable standard of pilot instruction. In doing so, they will have to take into consideration the varying commitments of the separate services; Belgium and the Netherlands, for instance, concentrate most of their resources in the maintenance of defending intercepter forces.

Direction of policy will at all times be under the four-power control of the Training Sub-committee of the Air Forces Western Europe organization, which is headed by G/C. D. S. Selway, Deputy Director of Training at the Air Ministry. Other members are Lt.-Col. de Soomer (Belgium), Col. Labit (France) and Lt.-Col Reynierse (the Netherlands), all of whom represent the training organizations of their own Air Forces.

Despite the obvious, innate differences in languages, customs and military backgrounds of its members, the Squadron is already working with a spirit of mutual purpose. That such a spirit, so essential to the success of Western Union, is present in these early days gives great hope for the future. R. J. B.

". . . Sunshot Palaces High that the White Clouds Build in the Breezy Sky"

Robert Bridges' line aptly fits the cloudscape—with a small but typical "anvil" building up in the distance—underlying this magnificent study of the B.O.A.C. Stratocruiser *Caledonia*.



The author of this book—which was published in Fleet Street in 1687—had some nebulous but not altogether fantastic ideas about lighter-than-air craft. Ninety-six years later, the Montgolfiers' hot-air balloon carried Pilâtre de Rozier aloft for five minutes.

PORTENTS IN PRINT

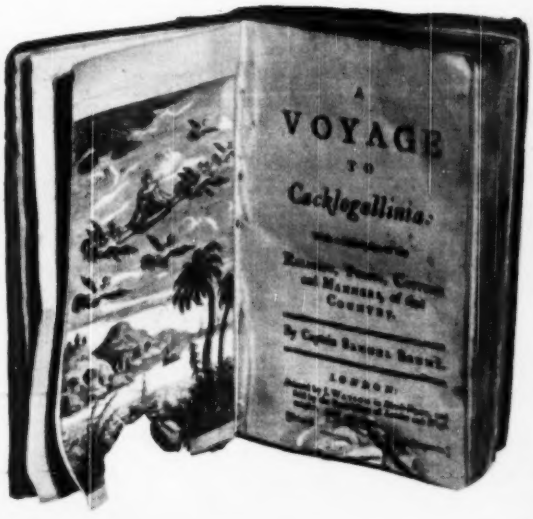
Two Curious and Valuable Relics of Early "Aviation Journalism"

A VOYAGE to the moon has long been one of mankind's oldest and most fascinating dreams, a powerful spur to the eventual conquest of the air, and the two books shown here were among the first in the English language to describe and illustrate fictitious journeys through the skies. The frontispiece to Captain Samuel Brunt's *Voyage to Cacklogallinia* (below), issued from Blackfriars in 1727 and thus anticipating by nearly 200 years the first number of *Flight*, propounds admittedly a rather primitive idea of aviation. Captain Brunt, an obvious imitator of Gulliver, suffers shipwreck on a desolate shore; suddenly he finds himself wafted luxuriously through the air in a stately palanquin supported by four Cacklogallinians, fantastic and powerful beings in the shape of birds. Alas, the invention was neither new nor very ingenious, for it derives from Bishop Francis Godwin, "a passing great lover of antiquity and all good literature" who, already a century before, had employed a gaggle of wild swans to transport to the moon his enterprising traveller Gonsales.

Cyrano de Bergerac's *Comical History of the States and Empires of the Worlds of the Moon and Sun* (1687), shown above, pretends to probe far deeper into the technical problems of human flight. The machine discernible in the engraving by van Hove is obviously an elaborate design with some claim to a scientific approach. The craft, on which the aviator "hewed, plained and glewed for the space of eight days" is described as a light box, about six feet high and three feet square, covered on the upper side with crystal glass. Here, the author says, convex and concave panes are so arranged in the form of an icosahedron that "my Bowl might produce the effect of a burning glass." The sun could create a vacuum in the icosahedron which must, he thought, "attract a great abundance of air whereby my Box would be carried up."

Even despite this cogent reasoning, the formidable engine might not, after all, have proved capable of rising from the ground; Cyrano therefore enlists, perhaps rather fortuitously, the aid of jet propulsion. Some soldiers, he tells us, coming across his aircraft in his absence, sought to make sport of the strange machine by attaching fireworks to the outside of the body. Cyrano returns as they are about to set fire to the work of his hands; desperately he throws himself into the machine, but too late to stop the mischief. A squib explodes and away he goes up in a cloud, "for as soon as the flame had devoured one tire of the squibs which were ranked by six and six by means of a train, another tire went off and then another." Soon he finds himself propelled high above the earth, until the attraction of a kindly moon takes care of his journey.

Though published 40 years after the 1687 work, this book scorns science. The four-bird-power aircraft had a fighter escort.



THE WAY TO SANTIAGO

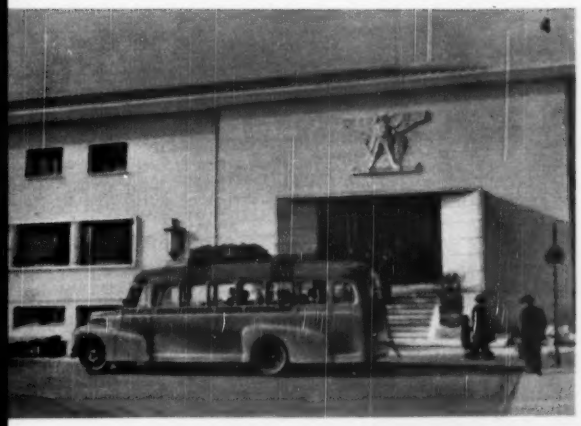
Argonaut's Pre-Service Flight to Chile via Portugal : A B.O.A.C. Photographic Record

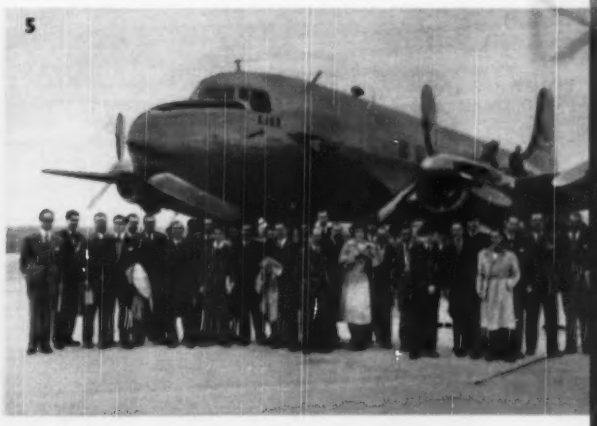
EARLIER this year, B.O.A.C. sent *Ajax*, one of their Canadair Four Argonauts (four Rolls-Royce Merlins) on a trade and demonstration flight to South America. It flew via Lisbon, Dakar, Natal, Rio de Janeiro, Sao Paulo, Montevideo, and Buenos Aires, finally crossing the Andes to Santiago.

As reported at the time, Mr. J. W. Booth (then deputy chairman), Sir Victor Tait (operations director) and Mr. Keith Granville (general manager, sales and traffic) and other officials were on board, and several hundred passengers were carried on some twenty demonstration flights.

Arrangements were made during the flight to meet government officials, leading citizens, and the representatives of aviation and travel organizations as well as potential customers from the general public, and to learn from all of them at first hand the traffic requirements and the

(1) Modern airport buildings and control tower at Dakar.
(2) A crowd lines the barrier to view *Ajax* at Lisbon.
(3) Roomy and comfortable, the Argonaut main cabin is brightened by gaily coloured curtains.
(4) Lisbon civil airport has an unusually attractive entrance. B.O.A.C.'s coach outside is clearly of Continental type.
(5) A large party of Portuguese officials and agents enjoyed demonstration flights in *Ajax*.

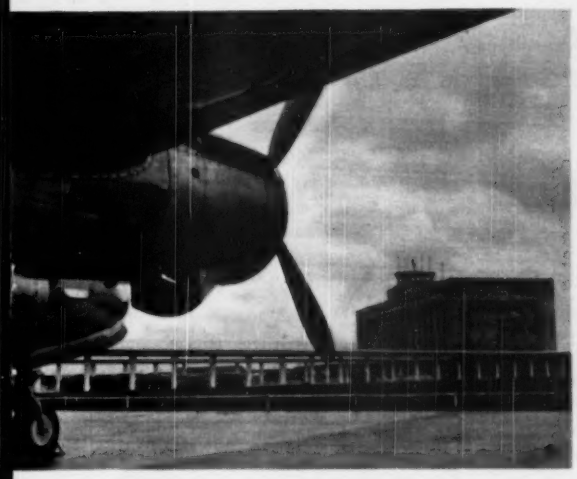


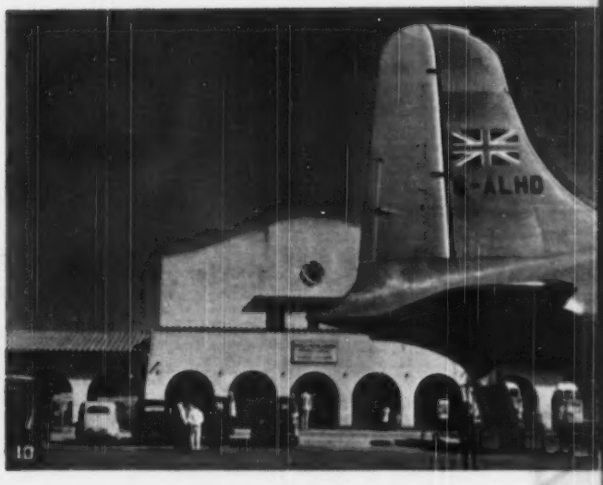


prospects of increased passenger and cargo business upon the introduction of faster and up-to-date aircraft on B.O.A.C.'s South American services. *Ajax* was commanded by Captain G. H. Womersley, D.S.O., D.F.C.

The first regular service was flown on February 28th. The Santiago service, leaving London each Tuesday, with a night stop at Buenos Aires, takes 56 hr 20 min (flying time, 35 hr 45 min); the return service, on Wednesdays, makes no night stop and takes 47 hr 5 min (flying time, 36hr 25 min). The Buenos Aires service—out on Thursdays, back on Mondays—has a flying time of 32 hr 25 min. On Wednesdays a London to Sao Paulo service is flown, returning on Fridays.

(6) *Ajax* high over the Andes and nearing the end of her flight to Santiago. The highest peak in this great range of mountains, seen on the left, is 24,000ft.
(7) The Canadair Four Argonaut at Santiago, in Chile.
(8) *Ajax* takes off for her return flight from Santiago.
(9) Framed by the Argonaut wing is the characteristic terminal block of the huge new civil airport at Buenos Aires.
(10) The airport buildings at Montevideo are of unusual style. Note the three English cars on the tarmac.
(11) Panama's international airport as seen from the approaching Argonaut. It is twenty miles from the city.
(12) The airport and harbour of Rio de Janeiro.
(13) The enchanting view of Rio from the air, with the familiar Sugarloaf mountain in the centre of the picture.





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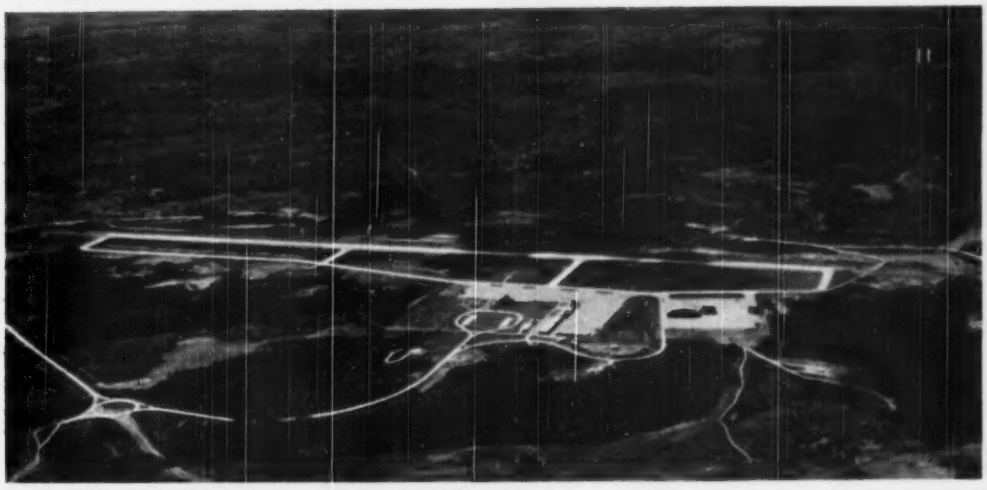
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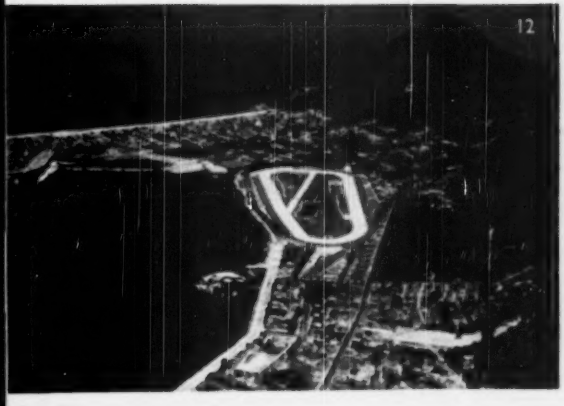
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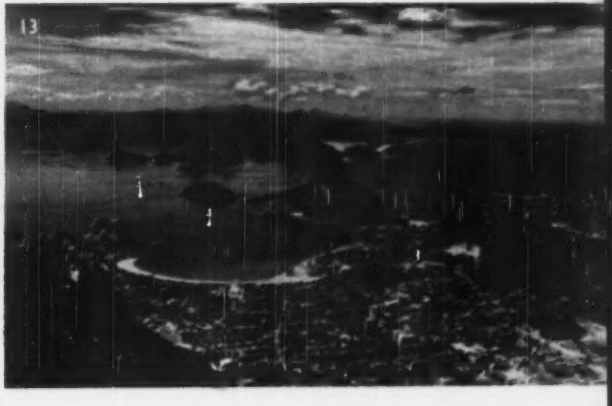
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FLIGHT-REFUELLING THE COMET

Possibilities on the North Atlantic Route Examined in an R.Ae.S. Lecture by C. H. Latimer-Needham

Of particular interest, coming as it did a week after Mr. Latimer-Needham's lecture, was a B.B.C. news item to which reference is made elsewhere in this issue.

FOR purposes of discussion it is generally accepted that the ultimate theoretical range of a modern airliner (e.g., the Stratocruiser) with no payload is approximately 6,000 miles, and that for efficient operation the payload and fuel load should be roughly equal. It follows, therefore, that ranges greater than 3,000 miles in still air can be achieved only by employing disproportionately large aircraft carrying relatively small payloads. An obvious method of overcoming this difficulty is, of course, to employ flight-refuelling, the practicability of which has been widely demonstrated in the last three years. Theoretical curves have been produced illustrating the difference between the performance of flight-refuelled and unrefuelled aircraft calculated on the bases of ton-miles versus range, cost and revenue versus range and profit versus range.

In assessing the value of flight-refuelling, one of the primary factors to be considered is the way in which payload increases with gross weight, as opposed to the diminishing payload of a non-refuelled aircraft designed for long-distance services. The employment of flight-refuelling undoubtedly dispenses with the need for "giant airliners" for long-distance services. In fact, it has been shown that, to carry the same payload, flight-refuelled aircraft need only be one-third the size of an unrefuelled aircraft designed to take-off with sufficient fuel for a 5,000-mile flight.

There is perhaps no route throughout the world on which competition is keener and speed more essential than that which crosses the North Atlantic. Moreover, the dollar-earning potentialities of the U.K.-North American services are of the greatest importance to Britain. There is at present considerable speculation as to the use of the D.H. Comet on these routes and in this connection the possibilities of employing flight-refuelling provide rather more than mere food for thought.

As part of a section lecture* delivered to the Royal Aeronautical Society on April 25th, Mr. C. H. Latimer-Needham, M.Sc., F.R.Ae.S., chief engineer, Flight Refuelling, Ltd., demonstrated the theoretical economics of a flight-refuelled Comet service on the London-New York route. His figures were based on payload assumptions of 12,000 lb for 105,000 lb a.u.w. (the Comet's present figures) but results are also given for the payload of 14,000 lb at 110,000 a.u.w. which is expected in the fully developed version. On westward journeys it was shown that capacity payloads (both versions) could be carried against headwinds of 91 m.p.h., giving a 90 per cent regularity. Refuelling would take place up to 250 miles beyond Shannon, at which point the fuel transfer would be 2,020 gallons, and over Gander, where a further 1,600 gallons would be taken on board. In the event of a refuelling failure the Comet could return to London, if necessary, from the first refuelling point, and it could also reach Halifax from the Gander refuelling point. As an alternative to New York, the aircraft could reach Washington with fuel taken on at Gander.

On the eastward run, the Comet would refuel only in the vicinity of Gander, although in an emergency contact could be made with the Shannon tanker. Capacity payloads could also be transported with a winter regularity of 90 per cent in this direction. The journey time for the two runs with average winds would be 9¼ and 7¼ hr respectively, or roughly half the shortest times achieved on present schedules. As a return trip would thus be possible in 17 hr, allowing for a turn-round of 3½ hr at each terminus, a single aircraft would be capable of making the double crossing in 24 hr. On this basis the Comet could provide a daily return service on six days per week, leaving one day for maintenance; an annual utilization of 5,000 hr thus becomes a practical proposition.

A comparison of flight-refuelled and stopping services that might be made by the Comet on the North Atlantic route showed, said the lecturer, that a 95 per cent regularity was impracticable for the stopping service. Failing the use of Iceland as an additional landing point under conditions of high wind, the stopping service allowed for a regularity of only 85 per cent, and even this would entail a reduction in payload and increases in journey time, which would ultimately decrease the utilization figure. (The main comparative details of the two services are shown in Table I.)

TABLE I: D.H. Comet on London-New York Route

	Flight-Refuelled	Stopping Service
WESTBOUND		
Annual regularity	95 per cent	85 per cent
Payload at 105,000 lb a.u.w.	12,000 lb	2,500 lb (equipped for 28 pass.) 8,350 lb (equipped for 36 pass.)
Payload at 110,000 lb a.u.w.	14,000 lb	
Journey time (average winds) ...	9.5 hr	12.15 hr (incl. two stops of 1 hr)
EASTBOUND		
Annual regularity	95 per cent	85 per cent
Payload at 105,000 lb a.u.w.	12,000 lb	11,000 lb (only 28 pass.) 12,000 lb (only 36 pass.)
Payload at 110,000 lb a.u.w.	14,000 lb	
Journey time (average winds) ...	7.5 hr	8.85 hr (inc. one stop of 1 hr)

With calculations based on the revenue rates given by Mr. Peter Masefield in his fourth British Commonwealth and Empire Lecture to the R.Ae.S., in September, 1948, and on operating costs as determined by the S.B.A.C. standard method, Mr. Latimer-Needham gave an estimate of the potential profits which could be realized by using flight-refuelled Comets on the North Atlantic route. Table II shows high utilizations which could be achieved. These are based on a return flight of 17 hr under working maximum conditions, and make ample provision for maintenance.

TABLE II: Airline Operation

Return Services per day	Fleet Strength	Total Hours per annum	Utilization (hr)
1	2	6,200	3,100
2	3	12,400	4,133
3	4	18,600	4,650
4	5	24,800	4,960

The lecturer explained that although Mr. Masefield's revenue figures were now somewhat out of date, they nevertheless enabled direct comparisons to be made between the Comet and other aircraft treated in his paper. As fare rates had since risen, the present picture, he said, would be even better than that shown.

At a payload capacity of 12,000 lb, the 100 per cent load-

* "*Flight Refuelling and the Problem of Ranges*"

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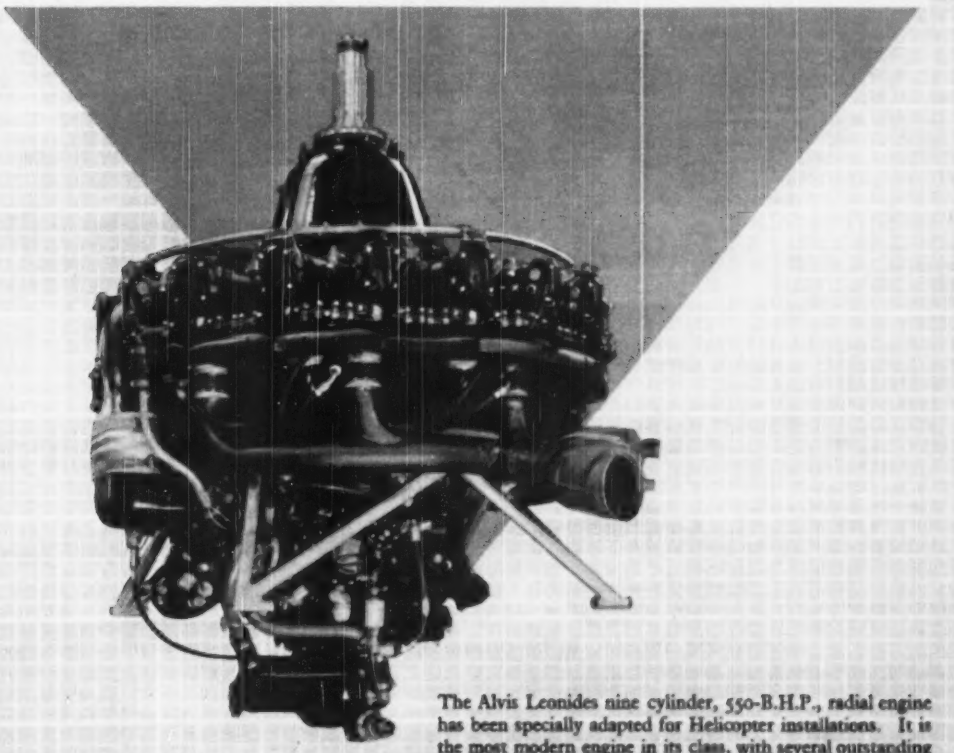
the Power Plant of the Westland-Sikorsky S.51 Helicopter



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British Airmanship sums up the reputation for skill, enterprise and reliability which in just over a generation of air travel has become inseparably associated with British airmen — something, indeed, to be proud of.

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FLIGHT-REFUELLING THE COMET . . .

factor was composed of: passengers, 4.5 tons; mail, 0.5 tons and freight 0.5 tons. On this basis gross revenues for various passenger load-factors were calculated; they are shown in Table III.

Calculated by the S.B.A.C. method, the direct operating costs amounted to £231 per aircraft hour. Estimating the cost of flight-refuelling at £64 per aircraft hour, the total cost would, therefore, be £295 per aircraft hour, or £0.109 per capacity ton-mile. At a 65 per cent load-factor the cost of operating a revenue ton-mile would be £0.153, and at the same load-factor the profits would, therefore, amount to £0.095 per capacity ton-mile and £0.132 per revenue ton-mile. The variations of cost with frequency, and utilization and revenue with load-factor, are shown graphically in Fig. 1.

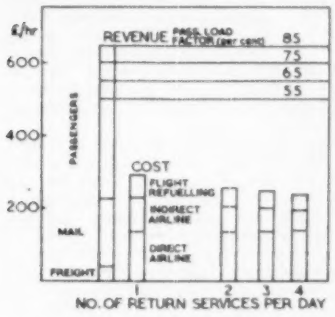


Fig. 1. Cost and revenue per hour for a D.H. Comet flying non-stop from London to New York with flight refuelling.

From these results Mr. Latimer-Needham concluded that a Comet service could be profitably run on the North Atlantic route. He considered that although overheads were likely to be greater, and that utilization might not achieve the maximum—even if the present cost estimates were doubled—the Comet would still break even at a 75 per cent load-factor. At the present rate of passenger fares, it would do even better.

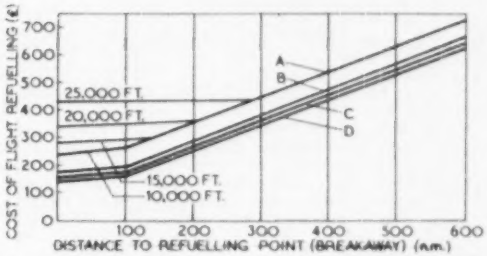
A comparison with the best unrefuelled stopping service on the same route showed that the Comet's profit figure of £0.132 per revenue ton-mile compared very favourably with the maximum long-range profit of £0.08 given by Mr. Masefield for the Constellation on a stage-length of some 2,400 miles.

On the subject of flight-refuelling costs, the lecturer said that when operations were conducted on a regular basis, the costs could be calculated from the known position and altitude at which the refuelling took place, the consequent performance required of the tanker, and the number of scheduled airline flights per day. The possible geographical remoteness of the tanker-station demanded self-sufficiency from the maintenance aspect and 100 per cent serviceability of its tankers to ensure regularity of service.

TABLE III: Gross Revenue at various Load-factors

Passenger Load-Factor (per cent)	Total Payload (tons)	Gross Revenue (£)					
		Passenger per mile	Mail and Freight per mile	Total per Mile	Per Capacity ton-mile	Per Revenue Ton-mile	Per Flying Hour
85	4.82	0.863	0.458	1.321	0.24	0.275	646
75	4.37	0.76	0.458	1.218	0.222	0.279	598
65	3.93	0.66	0.458	1.118	0.204	0.285	550
55	3.48	0.56	0.458	1.018	0.185	0.293	500

To estimate the cost of a refuelling service for non-stop North Atlantic schedules by the Comet and Bristol 175 a standard "task and cost" chart had been developed. This showed, the lecturer said, that for three refuellings per day from one station, carried out at an altitude of 20,000ft at a radius of approximately 200 miles, the total cost per operation would be in the region of £250. According to Mr. Masefield's calculations the average airliner landing and take-off cost per ton of gross weight amounted to £4 10s, so that the sum of £250 might equal the amount saved by avoiding landing on an aircraft of about 135,000 lb. In this case, said the lecturer, all the other benefits of increased payload and decreased flight time would be provided virtually free of charge. The trend of refuelling costs per tanker flying hour and per operation varied with the distance from base to the refuelling point, and, as shown in Fig. (2), tended to become constant if more than four refuellings per day were carried out.



A — One refuelling per day. C — Three refuellings per day.
B — Two refuellings per day. D — Four refuellings per day.

Fig. 2. Variations of flight refuelling cost with height and distance.

THE UNCIVIL WAR

"History of United States Naval Aviation," by Archibald D. Turnbull and Clifford L. Lord. Published in England by the Oxford University Press, Amen House, Warwick Square, London, E.C.4. Price 40s.

BACK in 1910, there was a young U.S. Naval officer named Enterprising Elmer, who had an urge to fly. Unfortunately, he had a wicked uncle, also in the Navy, who went by the name of Battleship Admiral, and a jealous cousin in the Army Air Service, both of whom emphasized in no uncertain way that the proper place for a young Naval officer was aboard ship and not up in one of those new-fangled flying machines.

But Enterprising Elmer, undaunted, simply turned his cap back to front, donned his goggles and took off in his Curtiss flying-boat, defying his wicked uncle, his jealous cousin and the law of gravity to do their worst. They did—for 35 years. But (proving once again that virtue always triumphs) at the end of that time we find Elmer, himself a fully-fledged admiral, surrounded by 60,747 little Elmers, while the wicked uncle and his battleships are either at the bottom of the sea or C.M. (Confined to Mothballs).

Captain Turnbull and Lt.-Cdr. Lord tell the story in a rather more dignified way in their *History of United States Naval Aviation*, but it amounts to the same thing. Quoting from the dust cover, for example: "It is a plain-spoken story—based on official sources—of how a handful of devoted young men fought a long and wearisome war against those who thought of the 'plane as an interloper, a preposterous challenger of the power of the great warship. It tells how the crusade was fought on every front, how the battle against technical obstacles was as hardly won as that over the minds of many in places of high authority."

Almost as an afterthought, it seems, the book also devotes 15 of its 345 pages to the story of how U.S. Naval Aviation fought another war against Germany and Japan from 1941 to 1945.

On the whole, however, this is a good, if sometimes too solid, record of the growth of a very fine Service. Like so many other American aviation histories, it would have been better if Service rivalries had not been allowed to play such a big part in the story.

J. W. R. T.

THE LIFE OF A TURBOPROP

Part II of Mr. R. N. Dorey's Lecture to the S.A.E. in New York

In FLIGHT last week (pages 542-545) we presented a slightly abridged version of the paper which, dealing with the operational reliability of the Dart turboprop, was delivered by Mr. R. N. Dorey, O.B.E., B.Sc.Eng., F.R.Ae.S., at the recent S.A.E. Aeronautic Meeting in New York. In this continuation, also somewhat condensed, problems of control, icing, water/methanol injection and continuous-cruising limitations are discussed. Mr. Dorey is manager of the Rolls-Royce power plant and flight-development division at Hucknall.

WITH its bearing on the overall life of the engine [said Mr. Dorey] another very important item has to receive consideration—the question of engine control. The use of an airscrew on a turbine unit makes it essential for the r.p.m. and throttle-valve settings to be controlled on an established basis and not left to the pilot to vary one independently of the other. For civil use we adopt the view that this relationship must be achieved with the simplest possible system, and while meeting all conditions satisfactorily it must remain, as nearly as possible, a straightforward mechanical system.

We have on the Dart an interconnected throttle-c.s.u. system, in which for each throttle setting certain r.p.m. are selected automatically. The basis of this interconnection is the flame temperature in front of the nozzle guide-vanes of the high-pressure turbine. Limiting conditions of flame temperature have already been established and thousands of hours' flying and test-bed running have given an overall envelope inside which we consider we must operate.

At take-off conditions we allow the maximum flame temperature of 2,034 deg F absolute (1,130 deg K). For first-reduction climb this figure drops to 1,980 deg F absolute (1,100 deg K); for continuous climb it is 1,890 deg F absolute (1,050 deg K); and for cruise we keep constant b.h.p. We know already that we can complete a model test at 2,105 deg F absolute (1,170 deg K) for take-off and 2,034 deg F absolute (1,130 deg K) for cruise, but the conditions of the hot parts of the engine are such that this figure is the limit and would not give reliability in use over extended periods. Flame temperature selection, however, has to be done with due regard to specific fuel-consumption, and a compromise has to be made over the whole engine range to ensure that, while we have adequate margin from a reliability point of view, the temperature is high enough to keep the engine operating within economical limits.

Our straight interconnected control has obviously certain limitations. One of these is the correction it is necessary to apply to an airscrew turbine for change in ambient temperature conditions, i.e., r.p.m. and jet-pipe temperature relationship. Some manufacturers have resorted to automatic means for doing this job, but we take the view that, even if an automatic device were fitted, provision would have to be made in the design to cater for a fail-safe device. The fail-safe would have to put the control mechanism into the tropical position. This would result in limiting the take-off weight of the aircraft unnecessarily, and some means of mechanical over-ride would have to be provided as a precaution against failure of the automatic device.

We have decided to make use of this mechanical over-ride as the only means of making the necessary adjustment. The unit varies mechanically the relationship of the throttle valve and constant-speed unit, so that the pilot can open his engine up to take-off conditions and adjust the jet-pipe temperature up or down, to suit the ambient air temperature, by use of the datum control lever.

We have given very serious consideration to the use of a top-temperature limiter worked automatically from a jet-pipe thermocouple. Such a device would ensure that the pilot did not exceed the normal maximum jet-pipe temperature plus a margin, but we have refrained from including this unit in the Dart specification because we feel it may limit the pilot's freedom instantaneously to exceed his engine limitations in the interests of the safety of the aircraft.

Experience has shown that short bursts exceeding the jet-pipe limitations by up to seven seconds do not seriously harm the engine. The order of this over-temperature is from normal 1,005 deg F (540 deg C) to 1,205-1,295 deg F (650-700 deg C). The reason is that the metal temperature-rise is not instantaneous, and a certain time has to be allowed for heat soakage.

Eventually we may find that it is desirable to control the airscrew pitch directly through the jet-pipe temperature, and this, on the face of it, would make the best type of control technically. Whether the complications involved, together with the added gadgetry and unreliability are warranted, time and experience will tell.

Problems such as those of the control system have to be worked out in conjunction with the operator under active service conditions. To gain this experience, together with an overall picture of engine reliability, we are hopeful of having three Dakota aircraft operating as freighters in the hands of one or more operators during 1951.

We feel that we can retain a straightforward, simple control system by virtue of the fact that the engine is of the centrifugal-compressor type, where no worry as regards blower-surge need be considered when working out the controls. If a higher-compression engine of the axial type were being used, it is almost certain that an increase in complication would be necessary to ensure surge-free operation.

While not wishing to invite discussion on the relative merits of the axial or centrifugal airscrew turbine, our experience has shown that part of the price paid for the improved specific fuel-consumption and possibly lighter weight of the axial is a loss of handling flexibility and a general complication of the control mechanism. The flexibility of the Dart has been compared favourably with that of a piston engine.

Icing.—This paper would not be complete without some reference to icing. The means of dealing with ice are bound to reflect upon the overall reliability of the engine and steps are being taken to incorporate de-icing equipment as part of the engine itself. Actual flight results indicate that the centrifugal compressor can swallow large lumps of ice without damage. We therefore propose to apply electric de-icing to the leading edge of the air intake (Fig. 9, page 591) where, if ice forms, there is no fear that damage will be done in the de-icing process so far as the compressor is concerned. The rotating guide-vanes (inducers) on both the first-stage and second-stage impellers are made of steel.

Our experience, so far, makes it difficult to decide whether or not the aluminium inducer fails because of external damage or vibration or both. We do know, however, that the rotating steel guide-vane can deal with what might be termed normal foreign bodies—the odd nut, split pin, stone or lump of ice—without any harm. We have no protection of any type in the intake of the engine, since, if any type of screen was fitted, it would almost certainly be a first-class ice collector.

Use of Water/Methanol.—We propose to use water/

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THE LIFE OF A TURBOPROP . . .

methanol injection as a means of *restoring* take-off power—I would like to repeat the word "restoring"—under tropical conditions. The centrifugal engine has shown itself very responsive to water/methanol injection, both as regards the return we get in power and also the very effective wash

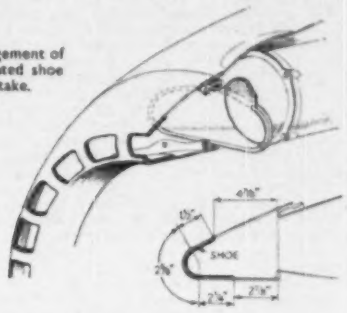


Fig. 9. Arrangement of electrically heated shoe for de-icing intake.

which the compressor parts get when injection takes place. This washing procedure, incidentally, may become a maintenance point when, after a certain number of hours, the engine is given a wash of water/methanol in order to restore the compressor performance—the effect of dirt on the centrifugal is less than on the axial; with no cleaning procedure, we lose about 2 per cent power in 250 hours.

A considerable amount of work has been done to establish the correct quantities, for the percentage of water in the mixture is quite critical. The common practice adopted on piston engines of having a mixture available at airports will have to be used with the airscrew turbine, and strict control maintained over the actual mixture proportions.

Our final production engines will have an automatic control which, working in conjunction with the torquemeter, caters for varying ambient temperatures up to the full 113 deg F (45 deg C) tropical case, varying the amount of injectant according to the day temperature and also correcting automatically the quantities injected at aerodromes above sea level. This unit will ensure that take-off power can be restored to the I.C.A.N. figure appertaining to that particular height (this is not the full 1,400 h.p. sea-level figure).

Operation.—We do not believe that the airscrew turbine will differ seriously in its method of operation from established piston-engine practice. We consider that the operating conditions will have to be determined by a compromise between the best the aircraft can do and the longest overhaul life possible from the engine. It will not be permissible—or possible or desirable—to take from this type of power plant powers up to the limiting type-tested conditions; but we do feel that the method of obtaining the power, and, in particular, flame-temperature control, does mean that the engine can be used at slightly higher *pro rata* powers than some of the piston engines, but still emphasizing that the extended use at full conditions would not give the overhaul life we envisage. This view may prick a bubble which has existed for some time that the turbine unit can be operated continuously near its maximum conditions.

To obtain the overhaul figure mentioned earlier, it will be necessary for continuous operation to work below limiting conditions, and when an analysis is done on potential aircraft performance, utilizing the airscrew turbine, we do not think a figure of 50 per cent of the full sea-level maximum power for continuous cruise at any height should be exceeded. At 25,000ft this represents 70 per cent of available power at 1,890 deg F absolute (1,050 deg K) flame temperature.

Conclusion.—A considerable amount of what has been said regarding the development of the turboprop is equally applicable to the pure jet, and several items on which I have elaborated are joint developments between ourselves and Pratt and Whitney on the pure-jet side.

A few words regarding the use of the turboprop would not be out of place. It is difficult technically—I emphasize technically—to make a convincing case for the turboprop aircraft against the pure-jet type, but we believe that its introduction is the next logical step in transport development. Apart from the increase in speed which is available for cruising, the reaction of the passengers is likely to be most favourable. To sit in an aircraft travelling at 300 m.p.h. with no noise and no vibration is an experience which is almost uncanny to those of us accustomed to the more orthodox machines. Economically it is possible to prove that the turboprop engine will pay. In addition, the problems which will have to be faced by airport control systems in handling turboprop aircraft are much closer to the piston-engined machine than they are to the pure jet.

Pullman Fares ?

I believe that it would be possible, on the introduction of aircraft powered by gas turbines, to regard them as Pullman coaches of the air, thereby entitling the operator to charge a higher fare for travel in this class of machine than for the third-class travel offered by the piston-engined machines.

Generally speaking, I also feel that the time is rapidly approaching when it should be possible to convert existing transports of the Constellation, DC-6, DC-4 and Stratocruiser types to turboprop power plants. Such a conversion would undoubtedly give the aircraft another lease of life and certainly give the passengers the additional peace and quiet which the advance in engine development has brought.

In these conversions it may be difficult, initially at any rate, to retain extreme ranges, but the advance in passenger comfort is such that the introduction of modified types on the internal air routes of the world would, we feel, make a great contribution towards civil aircraft development and, furthermore, take a step in the right direction to improve the travelling conditions.

All the indications up to the present are pointing towards an engine which will require very little maintenance. I am not so inexperienced as to believe we may not have real problems to face as soon as these engines are on the routes, but we are confident that basically we have the structure of a very reliable engine which, when coupled to the Viscount, is not overloaded (power loading is less than 10 lb/b.h.p.); and with experience we feel we shall make a real contribution to the future of civil aviation.

TURBOJET and TURBOPROP

Two Further S.A.E. Papers : Canadian and U.S. Contributors

Among other papers read at the S.A.E. National Aeronautic meeting, and also concerned with gas-turbine development, were the two complementary contributions summarized hereafter. In putting the case for the turbojet, Mr. Winnett Boyd had some particularly interesting things to say about overhaul life—he cited details of the 784-hour type-test-continuation run of the Avro Canada Orenda—while Mr. R. M. Hazen discussed, *inter alia*, the contentious subject of the relative complication of the control systems required for two basic types of gas turbine.

TURBOJETS — By Winnett Boyd

THE case for the turbojet was propounded by Mr. Winnett Boyd, assistant chief engineer and chief designer, Gas Turbine Engineering Division, A. V. Roe, Canada, Ltd. Mr. Boyd contended that modern (American) cars and premium-fare trains, together with luxury Transatlantic airliners, exemplified the public's insistence on speed and luxury of transportation, and the willingness to pay for those qualities. Thus, in considering air transportation after 1955, the speed ranges of different types of aircraft had to be taken into consideration.

It was doubted whether anyone had seriously considered the possibility of piston-engined transports flying at cruising speeds of 400 m.p.h. or better, as the two most potent arguments against such aircraft concerned the power-plant and passenger comfort. Turboprop transports could undoubtedly fly economically in the 400 to 500 m.p.h. cruising speed category and would thus be competing with the turbojet transport. Air transportation *after* 1955 was the issue at stake, and the discussion thus centred primarily around the advances and developments of the next 5½ years.

Although it was appreciated that two turboprop transports were now flying, they were both short- to medium-range aircraft, and had maximum cruising speeds of only 305 to 315 m.p.h. This was somewhat better than existing piston-engined aircraft, but was hardly enough really to catch the eye of the public. Not only would turboprop transports have to vie with piston-engined transports in the cruising speed category below

TURBOJET AND TURBOPROP

400 m.p.h., but—and this was a point which was frequently overlooked—they would also have to compete economically with turbojet transports flying at considerably higher speeds.

Turbojet transports would undoubtedly be first adopted for premium-fare runs, but would soon demonstrate their economy, and would subsequently displace their slower turboprop and piston-engined rivals on a large majority of the "bread-and-butter" runs. It was difficult to appreciate the reticence of the North American airlines towards turbojets as the first one to adopt them would force the pace for the others, and, after they had all taken the plunge, they would find that the water was more pleasant than they had expected—more pleasant, indeed, to the tune of considerably greater earnings on their investment. It should be mentioned that a Canadian airline had already ordered two long-range turbojet transports which were scheduled for delivery in 1952 and should thus be in service in 1953.

Many competent authorities had investigated the economics of the turbojet transport, and despite the engines' rather prolific thirst for fuel, the results had always been favourable. Mr. Boyd stated that very careful calculation had been made by his company, and it had been found that the turbojet transport would economically out-perform many of its slower turboprop and piston-engined rivals on a very large number of airline routes. Although it was true that turbojet transports would have higher costs per ton-mile than conventional types, the lecturer gave it as his opinion that the ton-mile basis of comparing transport aircraft was made obsolete by the advent of the turbojet. The fact that the latter had a block speed between 50 and 75 per cent higher than its rivals made the proper criterion for economical comparison the net unit earnings per ton-mile multiplied by the block speed. In other terms, the aircraft that flew faster would cover more miles in a year, and although its net unit earnings might be smaller, its gross earnings per year would be greater.

With reference to the performance which could be expected from jet units by January, 1956, Mr. Boyd ventured to predict that the characteristics of completely developed turbojets in that year would be as follows: Type, axial-flow; dry take-off thrust, 7,000 to 8,000 lb; minimum specific fuel consumption, 0.87 to 0.92 lb/hr/lb; overhaul life 1,000 hours; specific weight, 0.35 lb/lb t-o. thrust; specific frontal area, 1.33 sq ft/1,000 lb t-o. thrust; s.f.c. of unity or less from 35 per cent thrust up to full thrust.

Overhaul Periods

It would probably be thought that these predictions were unduly conservative, but, in the first place, although large engines of the type indicated would be built, smaller ones would also be available; nevertheless, whilst the latter would have about the same s.f.c. and overhaul life, they would have progressively larger specific weights and frontal areas reaching about 10 to 15 per cent greater at half the power. In the second place, any engine to be developed to a really reliable stage by January, 1956, would need to be running at the latest within the next 20 months. As to overhaul life, the significance of a 1,000-hour overhaul life in a turbojet should be fully understood; since a turbojet transport would travel anywhere from 50 to 75 per cent farther than a piston-engined transport in every hour, this overhaul life was equivalent to 1,500 to 1,750 hours for a piston engine. Furthermore, it was not thought that there would be major replacements during the first engine overhaul as it was confidently expected that these would be limited to the main bearings, the fuel pumps, a few nozzle guide-vanes and turbine blades, the insulating blankets and, perhaps, the nozzle-box liners. The 2,000-hour overhaul was expected to be a complete engine rebuild, and would include replacement of the gears and bearings, blades, nozzle-box liners, tail cone, and so forth. This would put the engine in shape for another 2,000 hours, with an overhaul at the mid-point. After this, i.e., 4,000 hours total engine running (equivalent in miles to 6,000-7,000 hours for a piston engine) it was expected that the second set of working parts would have been worn out, and that the main castings, etc., would have deteriorated to the point where the entire engine would have to be discarded. Engine maintenance between overhauls would probably be limited to fuel- and oil-filter cleaning, replacement of flame-tubes or combustion-chamber liners every 500 hours, replacement of some fuel and oil lines, and cleaning the igniter plugs every 100 hours.

Both to indicate the degree of reliability that turbojets were now achieving, and in substantiation of his predictions, Mr. Boyd gave performance details of the remarkable endurance run performed by the first Orenda that Avro Canada produced. Without a major overhaul, this engine ran for 784 hours, during which time it completed the 50-hour flight clearance, or 25-hour special category test, as well as the 150-hour endurance, or type-test, of the U.S., the U.K., and Canada—one after the other. In addition, it also completed 209 hours of miscellaneous running, including numerous accelerations and stalls, and all the running was done without derating the engine in any way. The endurance run was, in fact, terminated only by the fact that a member of the test crew accidentally dropped a bolt and a packet of razor blades into the intake. None of the engines blades was broken, but their leading and trailing edges were badly burred; the rest of the engine was undamaged. The only maintenance carried out during the endurance test was to replace certain lengths of flexible hose, the fuel pumps (after 500 hours), the flame tubes (after 300 and 600 hours) and six nozzle guide-vanes which were accidentally damaged.

Take-off jet-pipe temperature was maintained at 700 deg C as measured by stagnation thermo-couples, and a performance run which was made about two hours before the accident occurred indicated that, after all this running, the take-off thrust had dropped only by 75 lb. The engine was on the test stand from July 5th to November 10th, 1949, and, allowing for a two-week plant shut-down, this averaged approximately seven hours' running per day, including Saturdays and Sundays. A breakdown of all the development running of the Orenda to date gave 4.6 per cent at take-off thrust or better, 6.2 per cent at climb (92 per cent t-o. thrust), 30 per cent at maximum continuous cruise (81.5 per cent t-o. thrust), and 46.3 per cent at 65 per cent t-o. thrust and above.

TURBOPROPS

By R. M. Hazen

COMPLEMENTING Mr. Winnett Boyd's paper, the case for the turboprop was put by Mr. R. M. Hazen, director of engineering, Allison Division, General Motors Corporation. The turboprop was outstanding, he said, both in its ability to get a load off the ground, and in its specific fuel consumption. To what maximum cruising speed this advantage would be retained depended largely on the rate of development of airscrews, which in turn depended on the funds applied to their continued development.

Although proponents of the turbojet might agree that the economic advantages of the turboprop could be retained even to 500 m.p.h. or more, they would probably answer that turbojets were so much simpler that they would, in any case, be selected. This statement had some merit, but it should be examined a little more closely than merely by looking at a simple, single-compressor turbojet with a fixed nozzle as compared with a turboprop with its power section, drive-shaft, gearbox, airscrew and interconnecting controls. It could, however, be shown that the medium-compression-ratio turboprop had a large advantage over the low c.r. simple turbojet. A medium c.r. turbojet had, of course, an improved fuel consumption, but on examination this was found to be due more to the variable nozzle than to the higher compression-ratio, and the thrust was reduced with the better consumption; the weight had, therefore, gone up for each of these reasons. This made it all the more important that some form of augmentation be applied at take-off, and if this took the form of tailpipe burning (reheat) the variable nozzle was subjected to white-hot gas temperatures instead of merely red-hot gases.

In debating as to whether turboprop controls were more complicated than those of turbojets with variable nozzles and, possibly, afterburning, they should take into account the difference in temperatures at which the turboprop and the turbojet nozzle operated and, in addition, the hundreds of thousands of hours of airscrew operation which could be regarded as development experience. Whilst no supporting evidence could be presented as to the relative state of development of all the control and operating elements of the two types, it would seem most probable that turboprops with adequate airscrew and interconnecting controls would be more readily available to the airlines than would the turbojet with variable nozzle and thrust augmentation.

The dual-compressor turbojet introduced additional complications of driving the compressors at different speeds and absorbing the problems of high compression-ratio development, as well as complicating the control problem over and above that already referred to. Not much was known of the (ducted) fan-jet, but its problems would appear to be in the order of those of the turboprop rather than those of the turbojet with variable nozzle.

It was generally recognized that continued development of gas turbines relied chiefly on increasing the allowable maximum gas temperature, but it was not generally appreciated that there was a major difference in the way such temperature increases affected the turboprop as compared with the turbojet. The

TURBOJET AND TURBOPROP . . .

power of the turboprop increased rapidly with higher temperature, due to the increased output per pound of air used, and this power could be absorbed either by an increased power coefficient, or an increase of airscrew diameter. The percentage gained on the turbojet was, however, lower, owing to the less efficient high-temperature jet. Specific fuel consumption for the turboprop decreased steadily with higher temperature, whereas with the turbojet, the specific consumption increased, both at maximum and cruising thrusts; moreover, if the cruise temperature was held down, then no gain in thrust resulted. In other words, much more re-design was required for a turbojet to make good use of higher temperature operating limits.

The major point in the case of the turboprop in the U.S.A. was the availability of at least two sizes, which were basically designed for the Navy. Due to their light weight and size, these power units could be installed in practically all of the post-war fleet of military cargo and transport aircraft and, in addition, with an appreciable net gain in performance and operating economy. The difficult prototype aircraft problem was solved to the extent that prototypes could be equipped with turboprop units at the cost of nacelle changes. One such version was being made by General Motors on the Convair 240, using two single-turbine Allison 501 turboprops, primarily for flight "de-bugging," control development, and the development of operating techniques and features.

Within the next year, it could be expected that the Allison 500 (Navy T. 40) would have flown in two or three aircraft, and the model 501 (Navy T. 38) in one cargo aircraft in addition to the B-17 flight test-bed now being used and, as a result, evaluation of the turboprop in the U.S.A. would be much advanced. Mr. Hazen then suggested that, in the turbojet field, similar evaluation would have to come from experience with military bombers in the U.S., or from the British and Canadian prototype commercial aircraft.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Pictures and Names

ONE of my most cherished books is *Sail*, published in a limited edition in 1927 and containing reproductions of J. Spurling's exquisite paintings of Clipper ships. I was gloating over this volume the other evening and fell to wondering why no aeronautical artist has yet approached Spurling's ability to delight equally the artistic and the technical eye, though Leonard Bridgman and Frank Wootten have some admirable work to their credit.

After reading the letter from Mr. A. Jackson on the naming of B.E.A. aircraft (*Flight*, May 4th), I was also struck by the fact that the names of those old sailing craft—some of them as beautiful as the sea itself—have not, to my knowledge, been used for airliners. Many of the most picturesque, including *Flying Cloud*, were American-built ships. Others (I quote from memory) are *Red Jacket, Ariel, Taeping, Hesperus* (not the one in the poem!), *Sobraon, Harbinger, Lightning, Sir Lancelot, Anticipe, Brilliant*, and, of course, *Cutty Sark*.

London, W.11. W. H. S.

Flap Hinges

WE have been following with interest the colourful comments in your "American Notebook" series. In "Bon-Avion" (March 23rd) there appears a statement to the effect that external flap-hinge brackets can never pay their way. We would accept this statement with some reserve; if, for example, the emphasis is on a short take-off run, or good flying characteristics at low speeds, then the designer may well prefer to accept the small drag penalty concomitant with external flap brackets in preference to horrible alternatives such as a wing area sufficiently large to compensate for imperfect flaps or the not so "simple" (or light) parallel-type of control linkage advocated by Mr. Evans.

However, we are spared any difficult decisions of this nature because "a powerful slot action can be obtained" with the hinge pin "flush with the lower surface." This information will be received with surprise in many circles where there is a widespread impression that both flight and wind-tunnel data have shown that the hinge axis of an effective slotted flap must be located an appreciable fraction of the wing chord below the wing lower surface. Unless one is content with the moderate lift increments associated, for example, with conventional ailerons, it has been our experience that the "powerful" action referred to would apply only to the drag-producing qualities of the flap unless the hinge-axis location is very different from that recommended by Mr. Evans.

It would be appreciated if Mr. Evans would enlarge on these points.

R. D. HISCOCKS,
Chief Technical Engineer,
The de Havilland Aircraft of Canada, Ltd.

Toronto, Canada.

Strip-tearing

TO try to discover the origins of slang expressions can be an entertaining study, and Service and aviation slang is no exception. I have been wondering about that very odd process of "tearing off a strip," and have just recalled that 'way back in 1940 I had a wing commander who was given to issuing the threat, "I'll have him on a narrow strip of carpet."

Could this, I wonder, be the original version of "tearing off a strip," and do any of your readers remember hearing either expression before 1940?

STRIPLING.

Caterham, Surrey.

AT THE B.I.F.

Aeronautical Interest Among the Castle Bromwich Exhibits

IT would almost appear that some sort of understanding exists between the organizers of the B.I.F. and the S.B.A.C., whereby aeronautical exhibits are not shown at the former so that, presumably, they can be presented undiminished at Farnborough. Whether this be so or not, the fact remains that this year the Birmingham section of the Fair includes rather more items of direct aeronautical application than we have noticed in previous years. The Fair itself (which remains open until May 19th) appears to be much the same as ever: a glittering, busy concourse where the most unlikely objects are presented in exotic settings and English is just another language one happens to recognize.

At Castle Bromwich, the Airscrew Company and Jicwood, Ltd., have on show a selection of centrifugal and axial-flow fans, including small centrifugal units developed especially for recirculation use in pressurized cabins. Bakelite, Ltd., include in their display four mouldings which make up the flux-valve of the Sperry Gyrosyn compass, and among the variety of cables shown by British Insulated Callender's Cables, Ltd., are some examples specifically for aircraft use.

On the British Thomson-Houston stand are to be seen a large range of fractional horse-power motors, and the company's well-known electric tachometer equipment; Chance Brothers are exhibiting for the first time their new square-beam airport location beacon, and Chloride Batteries, Ltd., have on view the Exide 24-volt aircraft battery, which is claimed to be the lightest battery in the world for its power.

A working model of part of an airport, completely equipped with lighting apparatus, including the Calvert line-and-bar approach system, is one of the features of the General Electric Company's stand, together with examples of G.E.C. taxi way lights and high-intensity runway contact lights. I.T.D., Ltd., both show, and give working demonstrations of, a variety of their fork-lift trucks, and R. A. Lister and Co. exhibit various types of their well-known auto-trucks.

The Marconi stand gives prominence to the Type A.D. 7052 lightweight automatic D.F. equipment for aircraft, together with representations of radio installations in a large transport aircraft and a smaller feeder-service type. Another display of equipment designed particularly for small and medium-sized aircraft is the Type P.T.R. 61 V.H.F. transmitter/receiver on the Plessey stand. The Saunders Valve Co. have on show a comprehensive range of their valves, including the spherical-plug and taper-plug types already widely used in aircraft.

FOR CAREFREE TOURING

A "Fitting-out" Guide to Obligatory and Optional Equipment for Light Aircraft

WHEN a standard light aircraft is delivered by its manufacturers it carries all essentials for good-weather, visual-contact flying, but there is a large number of desirable and useful details of equipment which some owners may like to acquire. If the aircraft is to be flown at night or over water, or is to be used for overseas travel, several items are either obligatory or strongly to be recommended. Many such accessories are taken for granted by the users of military and larger commercial aircraft, but need to be specified by the club or private owner or by the charter operator.

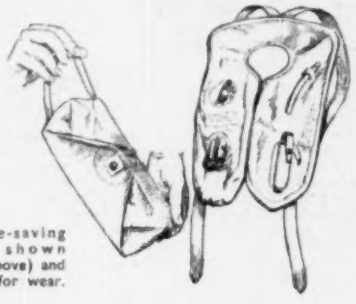
Under the general heading of "extras" there are several subdivisions, one of which is, of course, radio equipment. As this important subject has been dealt with in detail on more than one occasion recently, it will be omitted from this feature except to mention the special radio kits for use after ditching or a forced landing in remote country. The equipment usually comprises a transmitter, waterproof bags and a kite aerial. The weight is about 20 lb. Reference should be made to *Flight* dated January 19th, 1950, for an appraisal of radio-communication and radio-navigation sets for light aircraft.

Of first importance for everyday flying in this country is blind- and night-flying equipment. In addition to the standard types of turn-and-bank indicator and altimeter, most pilots endeavour to obtain a full complement of blind-flying instruments which, of course, includes an artificial horizon, directional gyro and sensitive altimeter, and (less often to-day) a climb-and-dive indicator. These costly instruments are more or less essential for sustained bad visibility or night flying, although, strangely enough, a pilot who is questioned about radio facilities is seldom asked if he has a full blind-flying panel before being given clearance in bad weather. Names of makers of instruments are listed at the end of this article. The principal gyro instruments cost new approximately £50 each, and an engine-driven vacuum pump about the same.

For night flying, navigation and identification lamps are required, also panel and cockpit lighting, and a landing light is desirable. It is difficult to give a price for the small lamps, and in some aircraft wiring may already be provided even if the lamps are not fitted as standard. Landing lamps cost around £20, and interior and navigation lamps between £2 and £5 for each one fitted. An electric torch is well worth its small weight and cost, and in addition to the everyday type obtainable almost anywhere, specially protected flameproof and/or floating versions are produced by such companies as G.E.C., Vidor, Ltd., and the Concordia Electric Safety Lamp Co., Ltd.

Much of the equipment, and in particular the radio, depends upon an adequate electrical power supply. If increased demands are likely to be made upon power supplies it may be advisable to fit an accumulator of greater capacity or add a second one. More than one company specializes in the production of such units, and names are listed under the heading of electrical equipment. Generators, which are by no means a standard fitment on light aircraft, may be engine-driven or, occasionally, wind-driven. Rotax are a company particularly well known as manufacturers of all kinds of generators.

Another class of special equipment may be referred to under the heading of safety apparatus, survival, first-aid and fire-fighting kit being included. For the many pilots who each year fly to Ireland, the Continent, the Channel Islands and Scandinavia in light aircraft, this sort of equipment is of special interest. Most pilots who undertake sea crossings like to have either personal life jackets of the Mae West or a rather more simple type, or a dinghy. Many kinds of such flotation gear are produced by the R.F.D. Company, and also by Siebe Gorman and Co., Ltd., and others. Jackets are not cumbersome to wear, and when folded into a small roll (R.F.D. 4in diam., 8½in long,

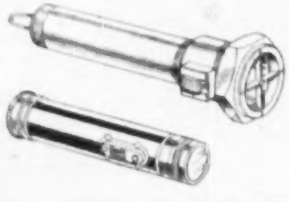


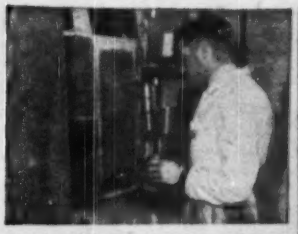
R.F.D. life-saving jacket, shown packed (above) and unpacked for wear.

1 lb 14 oz in weight) are easy to stow away in the aircraft. A small inflation bottle is provided, also a valve for blowing up by mouth. A torch, a whistle and in some cases a fluorescine block dye sea-marker are provided in the jacket. A representative price per unit is £3 10s. Gieves, Ltd., supply a neat "windbreaker" type of jacket, primarily intended for yachtsmen, but equally suitable for flying; made of gaberdine, it has an inner rubber envelope lining containing buoyancy material of the Kapok type.

Dinghies are naturally heavier and bulkier than life jackets, but can nevertheless be kept well within the carrying capacity of a very small aircraft. War-surplus single-seat "K" dinghies have become familiar playthings at swimming pools and the seaside. One version for single-seat Service aircraft is packed into cushion shape and the pilot sits on it. The latest type of "K" dinghy and the three-seater "M" dinghy are both suitable for carriage in light aircraft. For anyone contemplating an ambitious flight in a light or medium-sized aircraft involving extensive sea crossings, it is of interest to note that the R.F.D. Company have estimated that the weight of complete installations of sea rescue provision are as follows: One person, 10-16 lb; two persons, 41 lb; three persons (including radio transmitter), 85 lb; four persons (including radio transmitter), 100-110 lb. For Channel and similar crossings the

(Left) G.E.C. safety and standard electric torches.
(Below) Vidor rubber-sheathed waterproof torch.
(Right) Neat tail navigation-light by Rotax.





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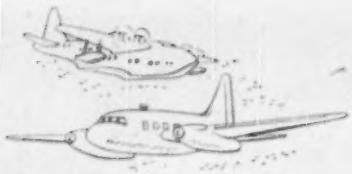

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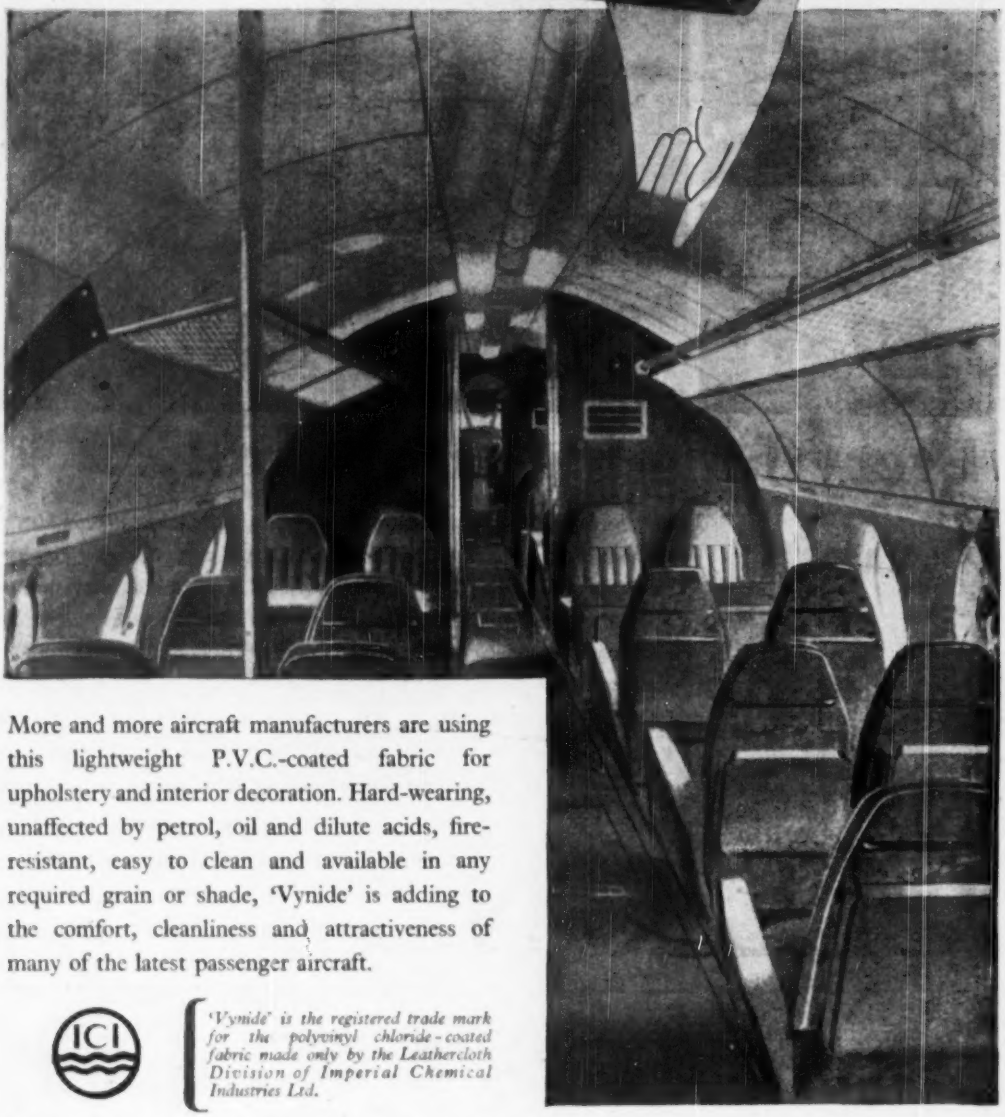

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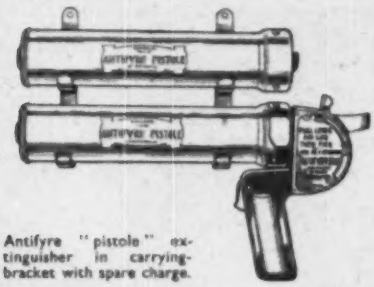
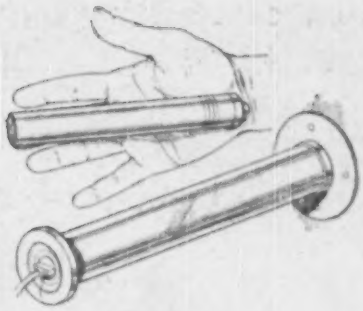


Antifyre "pistole" extinguisher in carrying-bracket with spare charge.



Two Schermuly pyrotechnic items: Parachute-flare ejector for light aircraft and (above) the two-star combined flare for dinghy use.

weight for four people would vary between about 8 lb and 50 lb according to whether jackets or a dinghy were carried.

All aircraft must contain a first-aid kit, and the essential items may either be collected together by the owner or bought as a kit from a chemist or a company specializing in the provision of this sort of equipment in containers suitable for aircraft.

Fire extinguishers exist in many forms, and so a pilot may make his choice from the selection. One widely-used type in the form of a "pistole" and charge is manufactured by Antifyre, Ltd. It produces a fine extinguishing cloud, neither liquid nor gas, effective against petrol and electrical fires. The pistole is 14in long, and with charge weighs 3¼ lb. The price with one spare charge and a mounting bracket, according to finish (enamel or chromium), is £3 7s 6d or £5 5s. Small hand extinguishers employing methyl bromide or a proprietary liquid as medium, are made by the majority of the firms mentioned under the heading "Fire-extinguishing Equipment" at the end of this article.

Under the general heading of signalling devices and pyrotechnics for aircraft two main classes of materials overlap in their applications. They may be of value as normal and emergency night-flying pyrotechnics, also for distress signalling in the event of a forced landing in uninhabited country. Pilots contemplating flights over mountains, jungle or desert would do well to consider carrying such equipment. For night flying a simple 1¼in Very pistol with appropriate cartridges should be carried (although great care must be exercised when discharging the pistol from a light aircraft which has no special tube or socket provided for the purpose. A smaller 1-inch dinghy pistol is an alternative. The Schermuly Company (Schermuly Pistol Rocket Apparatus, Ltd.) recommend three pyrotechnics for aircraft engaged in night flying: the light-aircraft parachute flare; the two-star combined flare distress signal; and the rocket parachute location signal. The first, examples of which have been seen on B.E.A.'s night mail helicopters, is for assistance in an emergency landing; the second and third, for assisting a search party or searching aircraft in locating survivors from a crash or forced landing. Very cartridges, and signal pyrotechnics in general, are also manufactured by the Y.S.C. Co., Ltd., patentees of Holt flares.

Reference has already been made to emergency radio transmitters, chemical sea-markers, and special electric torches, but there remains one extremely simple device, namely, the stainless-steel heliograph mirror. From experiment it has been found that on a bright day signals can be transmitted over a distance of nearly 10 miles.

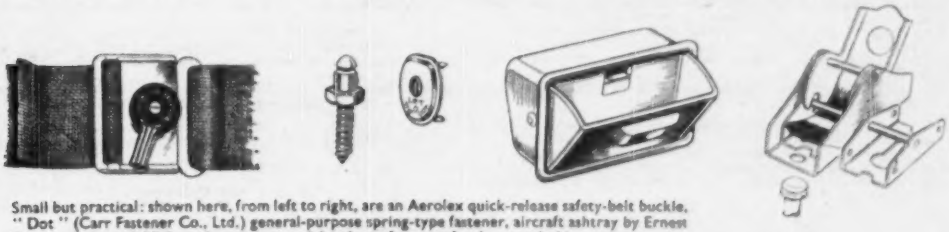
Special emergency packs can be prepared on request to cover possible requirements over land and water in any part of the world. Tinned liquids, concentrated food tablets, and several of the devices already described, are contained in standard emergency packs for light and heavy aircraft. A typical example for a two/three-seater aircraft for use in a dinghy after ditching, weighs 25 lb and contains first-aid kit, various signalling devices, rations, liquids, and a sea water de-salting unit.

For those who may wish to convert, re-engine, or rebuild aircraft, a number of special materials and fittings are produced to meet a variety of requirements. As an example, in the small-fitting category personal preferences are adequately catered for by the large number of ingenious cowling and panel fasteners now available. As with other equipment, manufacturers are listed below. Leather and plastic materials for trimming, and the clips, studs and zips associated with cushions, pockets and headrests in the cabin, offer considerable scope for individual taste.

For a relatively small cost, the harness fasteners fitted as standard equipment in certain aircraft may be exchanged for more convenient and attractive designs offering simpler attachment and adjustment.

It is well for the owner to give consideration to the type and colour of finish which is applied to an aircraft. High-gloss paint, for example, may have advantages beyond mere appearance and possible aerodynamic improvement, and its heat-absorption and reflection qualities should not be overlooked, particularly if the aircraft may be left for long periods in the hot sunshine of the Mediterranean or tropical countries. The names of Cellon, Docker Bros., I.C.I. and Titanine are well known as those of companies specializing in aircraft finishes.

Flying clothing becomes less important to the light-aircraft pilot now that enclosed cockpits are the rule rather than the exception. However, there are still many open light aircraft flying in addition to ultra-lights and gliders, and in such as these helmets, goggles and gauntlets are still a necessity for many months of the year. Moreover, comfortable overalls are still favoured by many pilots in



Small but practical: shown here, from left to right, are an Aerolex quick-release safety-belt buckle, "Dot" (Carr Fastener Co., Ltd.) general-purpose spring-type fastener, aircraft ashtray by Ernest Turner, Ltd., and Vickers-Armstrongs quick-release fastener for luggage lashing straps.

FOR CAREFREE TOURING . . . .

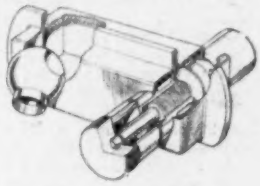
all types of aircraft, for even the cleanest of machines can be hard on one's suiting. It will be some years before all Tiger Moths and Magisters are replaced as club instructional aircraft.

It is to be assumed that a pilot will have accumulated maps and navigational instruments according to his needs, but certain special aids in the form of guides to airfields, airfield facilities and regulations are available. Every British pilot will know that the Royal Aero Club and the Aviation Centre at Londonderry House offer every sort of assistance to those wishing to fly at home or abroad, and that the fuel companies—Shell-Mex and B.P., Ltd., aviation division, for example—provide a great deal of assistance in the form of maps, routes and flight plans. Credit arrangements by carnet for fuel and servicing abroad is another service available from the Esso and Shell companies.

The *Aerad Flight Guide*, a publication of International Aeradio, Ltd., provides pilots with a convenient digest of the large mass of international route information which, unless carefully selected, must all be carried in flight.

Zipp-fastened white drill flying overalls by D. Lewis, Ltd.

(Above) Rotax dashboard-fitting hand-pump for windscreen de-icing. (Right) Silent cabin-ventilation louvre by Vickers-Armstrongs.



There remain one or two miscellaneous items which help to overcome the difficulties of flying in bad weather. For example, de-frosting solutions and a hand pump, for use in conjunction with windscreen wipers. Anti-rain preparations for transparent panels have been used with success during helicopter night flying—to cite one instance.

Seating, furnishings and details of cabin equipment—ash trays, ventilation—are rather outside the scope of this review, but some companies specializing in this work to whom reference could be made for quotations and advice are also listed below.

SOME SUPPLIERS OF EQUIPMENT

Electrical Equipment

Butlers, Ltd., Atlantic Works, Grange Rd., Small Heath, Birmingham, 10.—Landing lamps.
Chloride Electrical Storage Co., Ltd., Exide Works, Clifton Junction, nr. Manchester.—Exide batteries; electric torches.
Concordia Electric Safety Lamp Co., Ltd., Luma Works, Sanatorium Rd., Cardiff.—Safety electric torches.
General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.—Aircraft lighting equipment, electric torches.
Harley Aircraft Landing Lamps, Paxton Hill, St. Neots, Hunts.—Landing lamps.
Peto and Radford, Ltd., Dagenham Dock, Essex.—Dagenite batteries.
Rotax, Ltd., Willesden Junction, London, N.W.10.—Landing lamps, cabin lamps, also starters and generators, windscreen-wiper motors, warning horns and windscreen anti-icing hand pumps.
Siemens Electric Lamps and Supplies, Ltd., 38/39 Upper Thames St., London, E.C.4.—Interior lighting equipment.
Triplex Safety Glass Co., Ltd., 1 Albemarle St., London, W.1. Interior lighting.
Vidor, Ltd., West St., Erith, Kent.—Waterproof electric torches.

Fasteners, Clips, etc.

Aeroles, Ltd., Camberley, Surrey.—Quick-release harness buckles, lashing-gear, etc.
Carr Fastener Co., Ltd., Stapleford, Nottingham.—"Lift-the-toe" fasteners, gripper fasteners, turnbuttons, slide fasteners.
Dzus Fastener Europe, Ltd., 164-168 Westminster Bridge Rd., London, S.E.1.—Patented cowling and other fasteners.
King Aircraft Corporation, Fifth St., Montrose Ave., Hillington, Glasgow, S.W.2.—Toggle fasteners.
Napier and Son, Ltd., D., The Vale, Acton, London, W.3.—Cowling fasteners.
Oddie, Bradbury and Cull, Ltd., Oddie Fastener Dept., Portswood Rd., Southampton.—Quick-release fasteners and pins.
Riley, Robert, Ltd., Milkstone Spring Works, Rochdale.—Clips and springs.
Terry and Sons, Ltd., Herbert, Redditch, Worcs.—Fasteners, clips and springs.
Vickers-Armstrongs, Ltd., Weybridge Works, Weybridge, Surrey.—Quick-release fasteners.

Finishes and Dopes

Cellon Ltd., Kingston-on-Thames.
Docker Bros., Ladywood, Birmingham 16.
Hall and Sons (Bristol and London), Ltd., John, Hengrove, Bristol 4.
Imperial Chemical Industries, Ltd., Nobel House, 2 Buckingham Gate, London, S.W.1.
Titanine, Ltd., Colindale, London, N.W.9.

Fire-Extinguishing Equipment

Antifyre, Ltd., Shaftesbury Road, Acton, London, W.3.
General Fire Appliance Co., Ltd., 11 Waterloo Place, London, S.W.1.
Graviner Manufacturing Co., Ltd., Poyle Mill Works, Colnbrook, Bucks.
Kidde Co., Ltd., The Walter, Lux Works, Belvue Rd., Northolt, Middx.
National Fire Protection Co., Ltd., The, 201A Kingston Rd., Leatherhead, Surrey.
Pyrene Co., Ltd., The, 9 Grosvenor Gardens, London, S.W.1.

Instruments

Decca Navigator Co., Ltd., 1-3 Brixton Rd., London, S.W.9.
Hughes and Son, Ltd., Henry, New North Rd., Barkingside, Essex.
Kelvin, Bottomley and Baird, Ltd., Basingstoke, Hants.
Kent, Ltd., George, Luton, Beds.
Pullin and Co., Ltd., R. B., Phœnix Works, Great West Rd., Brentford, Middx.
Reid and Sigrist, Ltd., Braunstone Works, Braunstone, Leics.
Sangamo Weston, Ltd., Enfield, Middx.
Smiths Aircraft Instruments, Ltd. (and associated companies), Cricklewood, London, N.W.2.
Speed Development, Ltd. Marine Works, Sackville Rd., Hove, Sussex.—Stall-warning and fire-detecting switches.
Sperry Gyroscope Co., Ltd., Great West Rd., Brentford, Middx.
Wynn and Co., E. D., Montpellier Drive, Cheltenham, Glos.

Life-saving Flotation Gear

Frankenstein and Sons (Manchester), Ltd., Victoria Rubber Works, Newton Heath, Manchester 10.—Life-saving jackets.
Gieves, Ltd., 27 Old Bond St., London, W.1.—Life-saving clothing.
Kidde Co., Ltd., The Walter, Lux Works, Belvue Rd., Northolt, Middx.—Life vest inflation apparatus including automatic and manual valves, dinghy safety topping valves and hand-operating bellows, CO_2 cylinders.
London and Sons, Ltd., Louis, 61 Alie St., London, E.1.—Life-saving jackets.
R.F.D., Ltd., Catteshall Lane, Godalming, Surrey.—Dinghies, life jackets, emergency packs for sea, desert and arctic use, signalling equipment, first-aid kits, aircraft weather covers, flotation bags, protective clothing.
Siebe Gorman and Co., Ltd., Davis Road, Tolworth, Surbiton, Surrey.—Oxygen breathing apparatus, dinghies, lifebelts, etc.

Pyrotechnics

Schermuly Pistol Rocket Apparatus, Ltd., Spra Works, Newdigate, Surrey.
V.S.C., Ltd., The, Chines House, Underhill Road, London, S.E.22.

Seating and Upholstery

Christie-Tyler, Ltd., Seateeze Works, Bridgend, Glam.—Aircraft seats.
Connolly Bros. (Curriers), Ltd., Chalton St., Euston Rd., London,

(Continued overleaf)

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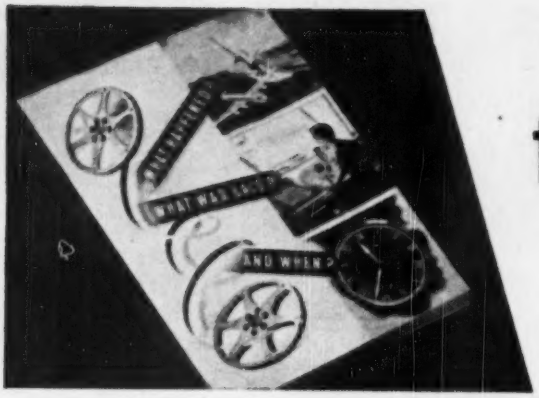

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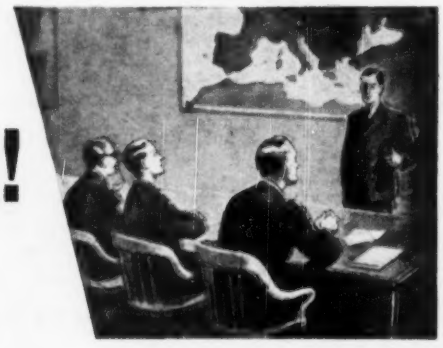


FOR CAREFREE TOURING . . .

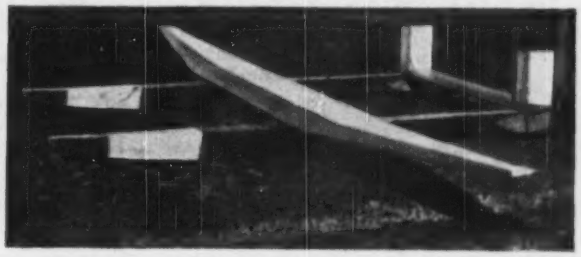
N.W.1.—Leather for aircraft-cabin upholstery and furnishings.
Firth and Sons, Ltd., T. F., Africa House, Kingsway, London, W.C.2.—Upholstery materials and lightweight carpeting.
Hairlok Co., Ltd., The, 117 Victoria Street, London, S.W.1.—Hairlok and Texfoam materials for cushions, headrests, seats, etc.
Imperial Chemical Industries, Ltd., Nobel House, 2 Buckingham Gate, London, S.W.1.—Rexine and Vynide fire-resisting leather cloths.
King Aircraft Corporation, Fifth St., Montrose Ave., Hillington, Glasgow, S.E.2.—Seats.
Lancefield Coachworks, 4 Wrentfield Place, London, W.10.—Chairs.
Latex Upholstery, Ltd., 41, Lonsdale Rd., Bayswater, London, W.11.—Cushions, shockproof padding, etc.
Moseley and Sons, Ltd., Ardwick, Manchester.—"Float-on-air" upholstery.
Moulded Components (Jablo), Ltd., Mill Lane, Waddon, Croydon, Surrey.—Cushioning.
Rumbold and Co., Ltd., L. A., Kingsgate Place, Kilburn, London, N.W.6.—Seats and soundproofing.
Tinkertex, Ltd., Holmfirth, nr. Huddersfield.—Mothproof and fireproof upholstery and curtaining materials.
Turner (London), Ltd., Ernest, Northdown House, Northdown St., King's Cross, London, N.1.—Upholstery and cabin fittings.
Wingham Bennett and Co., Ltd., Central Works, Central Ave., West Molesey, Surrey.—Adjustable aircraft seats.

Clothing and Miscellaneous Items

Fothergill, Taylor, Ltd., Woodside, Poynton, Cheshire.—Electrically heated flying clothing.
Gieves, Ltd., 27 Old Bond St., London, W.1.—Flying clothing.
Lewis, Ltd., D.—124 Great Portland St., London, W.1.—Suits, goggles, helmets and intercomm. equipment, all flying clothing.
Attewell and Sons, Ltd., Reflection Works, Southall, Middx.—Aircraft mirrors.
Goodyear Tyre and Rubber Co., Ltd., Wolverhampton.—Cross-wind landing gear.
Houdaille Hydraulic Suspension Co., Ltd., 814 Hampton Rd., Twickenham, Middx.—Windscreen wipers.
International Aeradio, Ltd., Aerad Services, Hayes Rd., Southall, Middx.—*Aerad Flight Guide* and consultative service.
Jones Clifton and Co., Ltd., William, 68 Hanson Street, London, W.1.—Engraved panels, identification labels, etc.
Meyrowitz, Ltd., E. B., 12 Old Bond St., London, W.1.—Goggles.
Polaroid (U.K.), Ltd., 81 Gracechurch St., London, E.C.3.—Variable-density and anti-glare windows, goggles, visors and other products incorporating "Polaroid" light-polarizing materials.
Shell-Mex and B.P., Ltd., Shell-Mex House, Strand, London, W.C.2.—Flight plans, fuel carnets.
Triplex Safety Glass Co., Ltd., 1 Albemarle St., London, W.1.—Plastic enclosures, safety glass, goggles.
Vickers-Armstrongs, Ltd., Weybridge Works, Weybridge, Surrey.—Ventilation louvres.
Wilkinson Rubber Linatex, Ltd., Frimley Road, Camberley, Surrey.—"Linatex" rubber seals for doors, etc.

TARGET-TOWING IN SWEDEN

Civil-operated Fireflies Give Excellent Results



The larger of the two types of targets has twin tail-booms and a wing-span of 30ft.

A RECENT demonstration of target-towing by the Swedish company Flygtjänst, which operates as a civilian unit at the service of the naval and military gunners, has stimulated interest in this aspect of training. The demonstration was given both at Copenhagen (Kastrup) and near Stockholm, at the secluded grass airfield of Ska Edeby.

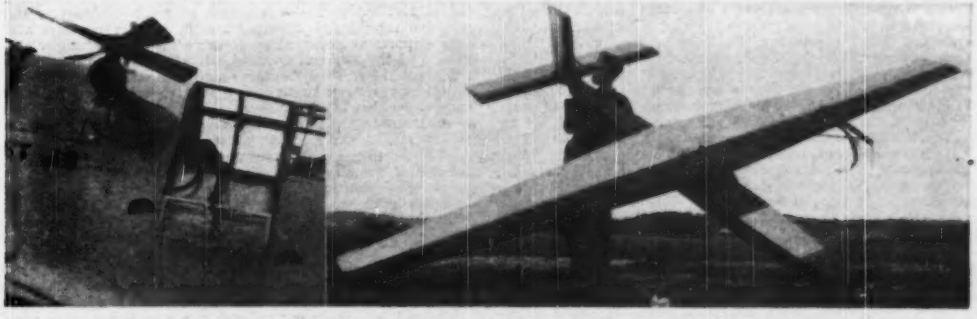
Using Fairey Firefly Mk. I target tugs, the Flygtjänst company last year piled up 1,200 hours of towing time, and during that period developed (under licence from the British R.F.D. Co.) a 30ft twin-boom winged target for ground-to-air or ship-to-air practice. Additionally, a 16ft winged target, banner target or sleeve can be towed. It is not generally known that the 16ft and 30ft targets have negative incidence: free from the tug, they have no lift and plunge to earth.

The technique of operation is as follows: The target is placed on the ground, head to wind; then the wire—of surprisingly fine gauge—is laid out ahead for about 75 yards and the aircraft is taxied into position. The wire from the target is attached with a straightforward knot to a lead wire which passes on guides into the rear cockpit and round a reeling drum. This drum is rotated by a windmill device, turned in the slipstream. (In practice, the windmill has far too much power, and an operator explained that it was possible in flight to haul in the 16ft target by hand.)

The pilot opens the throttle and for the initial stages of take-off holds the aircraft low over the ground, the target skidding and bumping along the surface. Airborne, and still at low altitude, the undercarriage is raised, and the aircraft still held low until about 150 knots is attained. The control column is then sharply pulled back, the aircraft climbs steeply, and the target—still 75 yards behind—is "yanked" off the ground. Then the aircraft levels off, and the target trails behind some 200ft. The wire is streamed to whatever length is required up to 7,000ft.

The manner of slipping the target (presuming—not unreasonably, alas!—that the gunners have failed to shoot it down) is as follows: The pilot manœuvres the aircraft to a straight approach into wind, altitude about 500ft, one mile from the airfield. With full flap, and throttled right back, he makes a "deck-landing," motored approach; by now the target is reeled in to about 75 yards astern and below. Height is reduced and a stage is reached where the trailing target contacts the ground. At the critical moment the operator cuts the cable and the target slithers to rest. The aircraft goes on to make a normal landing.

Two interesting points were evident in the demonstration. The first is that with a quickly manœuvrable aircraft like the Firefly, on a steep turn the target is actually travelling much



The tug's winch-windmill in the "feathered" position and (right) the 16ft target: note the skids and towing-cable attachments.

TARGET-TOWING IN SWEDEN . . .

faster than the aircraft—for the simple reason that it is moving through a much greater radius. Secondly, even in level flight the smallness of the target in relation to the aircraft gives an illusion of far higher speed. (Observers of the Comet at Farnborough last year may have noticed the phenomenon of its deceptive speed, due to its size. Suggestions were made that it should be flown side-by-side with a Vampire.)

In practice, Flygtjänst discovered another interesting fact. The best towing speed for the targets was in the 250-270 m.p.h. band. At first the straightforward design introduced an unexpected factor: at about 200 m.p.h. the target inverted and "flew" happily upside down. When the Firefly slowed down to below 200 m.p.h., however, it immediately righted itself. This idiosyncrasy was removed by extending the tail fins below the fuselage datum line.

Another interesting point, from practical experience, is that the Swedish Army and Navy requirements are for speeds nearer 180-200 m.p.h instead of those attainable by the Firefly. There are two reasons for this: the first is that faster targets do not permit "new boys" to be properly exercised, for they are out of range before being caught by the guns; secondly, great importance is attached to defence against parachute attack and torpedo-bomber attack—at 200 m.p.h. maximum.

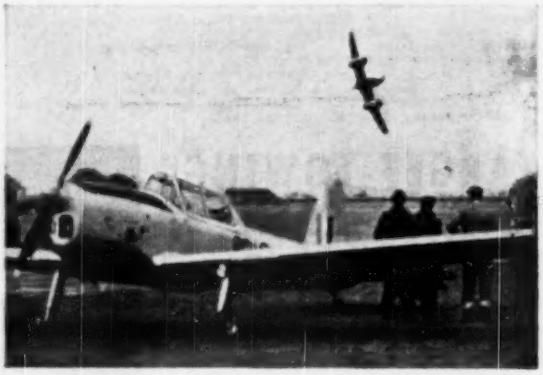
It is worth noting that Flygtjänst are carrying out this vital training work most successfully with a total roll of only 70, including administration, to operate and maintain in service no fewer than 15 aircraft.

UNDER THE OVERCAST

Undaunted by Weather, Cambridge Reservists Hold Successful "At Home"

ONLY in a meteorological sense was Cambridge Airport the centre, last Saturday, of an extremely deep depression. Despite torrential, incessant rain and a gloomy cloud-base which remained in the region of 500 ft, Cambridge University Air Squadron and No. 22 Reserve Flying School successfully presented almost every item on their fair-weather "At Home" programme. Between them, the two units have recently acquired 23 new Chipmunks; and the smart appearance and lively performance of these trim D.H. trainers helped to brighten a drab day for pilots and guests alike.

Throughout the afternoon, Chipmunks appeared in a variety of events. First came the treasure hunt—held this year on a restricted scale because of appalling conditions for pilot navigation. Varsity Flight (a 22 R.F.S. section composed of former C.U.A.S. members) won 75 points in this event, ensuring their final victory in the team competition. Then followed a first-class mass formation-flight by 12 Chipmunks in four vics, representing both R.F.S. and University pilots. There were also spot-landing and formation competitions, won, respectively, by F/O. Murphy of C.U.A.S. (six yards from the "spot") and the 22 R.F.S. team. In traditional manner, the Varsity Flight team were later presented with the silver rose-bowl trophy by A. Cdre. McEvoy, the A.O.C. No. 61 Reserve Group. This vessel, of eight pints' capacity, was the subject of further competition—after flying hours.



"Flight" photograph.

Despite dull skies over Cambridge, F/L. H. W. B. Patterson gave a lively aerobatic demonstration with a Meteor 7 from North Weald.

A welcome visitor during the afternoon was S/L. W. R. Sloane, a former C.O. of the Cambridge Reserve Centre, now a squadron commander at Wyton. Appearing on time through the overcast, his Lincoln made an impressive succession of low-level passes over the airfield. Further variety was provided by F/L. Patterson in a Meteor 7 of No. 601 Auxiliary Squadron, North Weald; a slight improvement in visibility permitted him to demonstrate manœuvres both original and dramatic. For showmanship, balanced with judgment, he shared honours with Mr. J. L. Ralling, a member of 22 R.F.S., whose delayed-drop parachute jump was one of the highlights of an excellent programme.

"SLOWER AND SAFER"

Sir Frederick Handley Page, in Louis Bleriot Lecture, Suggests a New Approach

THIS year's venue for the Louis Blériot Lecture, which is read annually to commemorate the achievements of the renowned French aeronaut, was the Hotel George V in Paris. Following what has now become almost a tradition (the lecture is read on alternate years in England and France) the Royal Aeronautical Society were the guests of the Association Française des Ingénieurs et Techniciens de l'Aéronautique. The lecturer was Sir Frederick Handley Page, C.B.E., F.R.Ae.S., and his paper, delivered last Thursday, May 4th, was entitled "Towards Slower and Safer Flying. Improved Take-off and Landing, and Cheaper Airports"; it was read for him in French by Ingénieur en Chef Pierrat, Chef de la Section Avions au Service Technique de l'Aéronautique. The R.Ae.S. was represented on the occasion by Sir John Buchanan, C.B.E., the Society's president, and Captain L. Pritchard, the secretary—both of whom, incidentally, are shortly to retire from these posts.

A party representing most of the British aviation organizations flew to Paris to take part in the proceedings, and the numerous local guests included the British Civil Air Attaché in Paris, the British Naval Attaché, representatives of the U.S. Embassy and a large gathering of distinguished personalities in French aviation. The president of A.F.I.T.A., M. Jarry, was the chairman, and the meeting was particularly honoured by the presence of M. Bréguet.

Judging from the enthusiasm with which the lecture was received, Sir Frederick's choice of subject was one to which French aviation authorities attach great importance. One of its main objects was to persuade operators, designers and airport authorities to consider with less resignation the excessive capital and upkeep costs for lengthy runways and large airports necessitated by to-day's faster and heavier aircraft, and the lecturer reviewed aircraft design developments which would lead towards some simplification of these problems by offering slower landing and shorter take-off runs. He enumerated details of research into methods of increasing lift by the creation of additional airflow over wing-flaps by special jet or rocket types of discharge, and discussed possible alternatives to the bulky and uneconomical undercarriage. In the case of the Hermes, Sir Frederick pointed out, this component accounted for almost 25 per cent of the payload.

Sir Frederick's unorthodox views clearly fired the receptive Gallic imagination, and at the subsequent dinner in the magnificent dining hall of the Aéro Club de France they were the subject of animated discussion; knives and forks became demonstration aircraft and components, and language difficulties clearly proved no barrier to the interchange of arguments *pro* and *con*.

Abstracts of the paper will be given in these pages next week.

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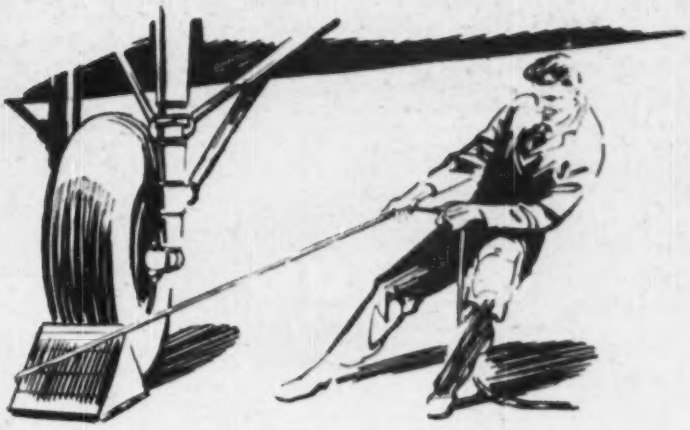

. . . these keen spare-time airmen*

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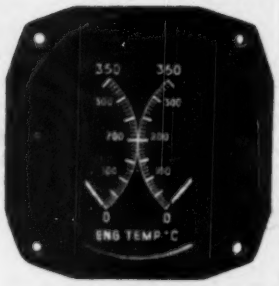

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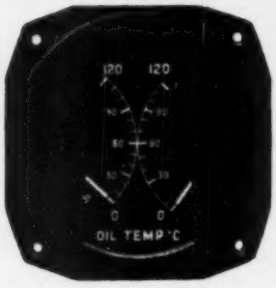

Illustrations show :

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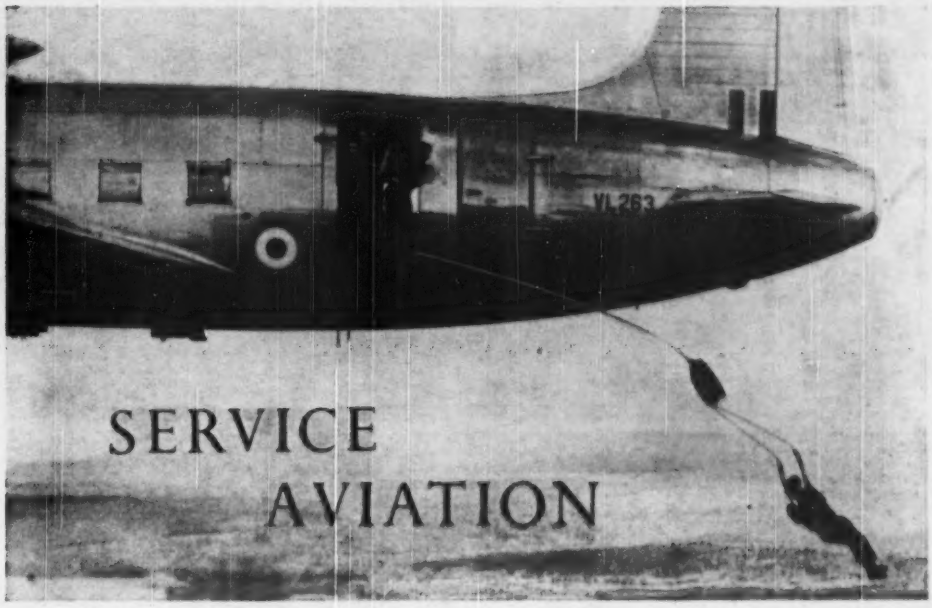

SERVICE AVIATION

GOING, GONE: A remarkable close-up of a Vickers Valetta, the R.A.F.'s latest twin-engined transport, with one paratroop "lying on the slip-stream" while a second prepares to make his exit. Beneath the fuselage are racks for supply containers.

Royal Air Force and Naval Aviation News and Announcements

Exercise "Unity"

THE Brussels Treaty Organization announces completion at Fontainbleau, on May 5th, of a periodic conference of senior officers of the three Services of the countries of Western Union and from the zones of occupation in Western Germany. Many important matters concerning the organization of the defence of Western Europe, both of policy and practice, underwent searching examination in study and discussion and the results of the conference were described as most profitable.

The meeting was held at the invitation of Field-Marshal Montgomery, Chairman of the Commanders-in-Chief's Committee, Western Europe, and was conducted by him.

Pathfinder Club Reconstituted

FOLLOWING a recent meeting of the Council of the Pathfinder Association, the Pathfinder Club has become the first London organization of its kind to provide for members and ex-members of all ranks of the R.A.F. The Club was founded in 1944 to foster and maintain the spirit and fellowship of the Pathfinder Force.

The Association states: "A bold step has been decided on. . . . The decision is to extend membership of the Club to all serving and ex-members of the R.A.F., believing that such facilities are vitally necessary in helping to maintain a healthy interest in the Service.

"This change of policy . . . will place at the disposal of all those who are accepted the complete services of a responsible club with close Air Force and civil aviation affiliations. The amenities for members and their guests include a restaurant and snack bar, residential service, and bar (at mess prices!).

"The Council are determined that the highest possible standard of service and comfort should be maintained, at the same time keeping the subscription within reasonable limits. It has therefore been decided that the scale of membership fees shall be: town members—two guineas; country members—one guinea."

Full details of membership may be obtained from The Secretary, Pathfinder Club, 115 Mount Street, Berkeley Square, London, W.1.

Operation "Caesar"

IN the recent change-over from British to Italian administration and the termination of British civil and military authority in Somalia—now returned to Italy under a 10-year U.N.O. trusteeship—the R.A.F. played a prominent part. The operation was planned by the Army's East Africa Command under the code name Operation *Caesar*.

A degree of tension during the change-over was foreseen, and to support the Army over this possibly critical period the R.A.F. flew into Mogadishu, capital of Somalia, Brigands from two Middle East squadrons and a squadron of Dakotas from Egypt. Eventually, owing to airfield congestion at Mogadishu, all but two of the Dakotas operated from Eastleigh, Kenya, Air Headquarters, East Africa. The small R.A.F. garrison at Mogadishu was strengthened and A.V-M. A. C. Stevens, C.B.E., then A.O.C., East Africa, made the capital his tactical H.Q.

Two possible contingencies were foreseen, one that in the event of civil disturbance the Army might need the assistance of the R.A.F., and the other that if the monsoon broke prematurely and roads become impassable, the R.A.F. would give the Army air support. Happily, neither contingency arose. Nevertheless, the R.A.F. had heavy commitments to discharge, which relieved the Army of a great deal of the burden of handover. These included a bi-weekly shuttle service between Eastleigh and Mogadishu, begun, at Army request, in early January. Dakotas flew in high-priority R.A.F. and Army equipment, passengers and foodstuffs, and also ran a courier-service, flying despatches, coded signals and other important communications in either direction.

Dakotas also flew to Aden a number of British officials who had handed over their duties to Italians, as well as a detachment of the Aden Protectorate Levies who had been doing garrison duties in Somalia during the change-over.

Second Exchange of Cadets

FOLLOWING a London conference between British, Canadian and American officials, details were announced of plans to repeat last year's successful exchange of cadets of the three countries. Fifty British A.T.C. cadets will be selected for two-week sight-seeing tours of Canada and America, 25 for each country.

The cadets will fly from Northolt on August 6th in the two aircraft which will, two days earlier, have brought 50 Canadian and U.S. cadets across the Atlantic for a corresponding stay in this country. The tours will, in each case,

SERVICE AVIATION . . .

enable the boys to visit aircraft factories and air force stations, beauty spots and places of historical interest.

New Director of Manning

GROUP CAPTAIN G. I. L. SAYE, C.B., O.B.E., A.F.C., takes the acting rank of Air Commodore on appointment to the Air Ministry as Director of Manning. Until recently he was Group Captain (Organization) at H.Q., Middle East Air Force.

Born in March, 1907, A.Cdre. Saye entered Cranwell as a cadet in 1925, and was commissioned in December, 1926. He served for seven years with flying-boat squadrons at Calshot and Mount Batten and was in the first R.A.F. crew to fly to Iceland in 1930. From 1934 to 1936 he was adjutant, Heliopolis, Egypt, and afterwards took the specialist navigation course at the School of Air Navigation, later becoming Navigation Staff Officer of No. 1 Bomber Group.

On the outbreak of war he went to France with H.Q., Advanced Air Striking Force, and after his return to the United Kingdom in 1940 was navigation staff officer, first with Flying Training Command, and later at Bomber Command Headquarters.

"Flight" photograph.

JUDGES: A recent scene at the Central Flying School during competition for the Clarkson Trophy, awarded at the graduation of each course to the student most proficient in aerobatics. Watching the individual displays were W/C. Huangmani (Siamese Air Force); the judges—W/C. C. D. Tomalin, S/L. F. L. Dodd, G/C. G. D. Stephenson (Commandant, C.F.S.), S/L. R. B. Morrison—and Maj. J. L. Wilk, an American Air Force officer commanding a C.F.S. Squadron under the exchange scheme.

R.Aux.A.F. Appointment

THE Air Ministry announces the following Royal Auxiliary Air Force appointment: Wing Commander Barnard Johnston Sandeman, to command No. 3602 (City of Glasgow) Fighter Control Unit.

Wing Commander Sandeman joined the R.A.F. as a pupil pilot in 1935, and was appointed to a short-service commission in the general duties branch the next year. After further training and a period of flying duty at home he served on flying duties in the Far East and Middle East until shortly after the outbreak of war, when he became chief ground instructor at No. 4 Service Flying Training School, Iraq, where he remained until April, 1941. Returning to England, he served with Nos. 86 and 489 Squadrons in 1942, and, in 1943, took command of No. 1 Torpedo Refresher School at Tain, and later of R.A.F. Station, Sumburgh. In September, 1944, W/C. Sandeman became Chief Instructor at No. 5 Operational Training Unit. He joined No. 17 Group the following June and was released from the Service in September, 1945.

Women's Service Visitor

COLONEL GERALDINE MAY, Director of the United States Women's Air Force, is now concluding a fortnight's visit to this country as a guest of the R.A.F. Colonel May enlisted in the Women's Army Auxiliary Corps in July, 1942, and was among the first eighteen officers to be assigned to the U.S.A.F. After filling various staff appointments, she became the first Director of the U.S.W.A.F. in June, 1948. She had never flown before entering the Service, but to date has covered over 300,000 miles by air. She was greeted at Northolt by the Director of the W.R.A.F., Air Commandant Dame Felicity Hanbury, who last year paid a visit to the U.S.W.A.F. in the United States.

"Flight" photograph.

COMPETITORS: The interest shown in the picture above was caused by aerobatic Harvards in the hands of the four finalist students: (left to right) F.L. De Salis (Clarkson Trophy winner), F.L. Petersen, Plt. Il Barrell and Plt. I Lavallin.

No. 3 F.T.S. Graduation

A NATIONAL Service man—Officer Cadet Alan Lawrence Bussey—was twice honoured when, recently, No. 25 (Pilots') Course of officers and cadets graduated at No. 3 Flying Training School, R.A.F. Station Feltwell, Norfolk. Officer Cadet Bussey won both the Sword of Merit awarded to the best all-round cadet of the graduating course and the "Glen" trophy presented to the cadet with the highest position in flying.

The graduation parade, was attended by parents and friends of the cadets and took place at Feltwell; the Reviewing Officer was A.V-M. A. Hesketh, C.B., C.B.E., D.F.C., Air Officer Commanding No. 3 Group, Bomber Command, who presented the 20 graduating pilots with their wings.

The Station Commander, G/C. J. G. Glen, O.B.E., announced in his report that Officer Cadet Bussey had attained a combined assessment on flying and ground instruction of 77.9 per cent, his flying assessment being 74.3 per cent. Congratulating No. 25 Course, the Group Captain said: "Its results are satisfactory and the members graduating to-day have every reason to be proud of their achievements during the last 12 months."

Officer Cadet Bussey, a former member of No. 775 A.T.C. Squadron (Reigate Grammar School), entered the R.A.F. direct from Reigate Grammar School. Next October he will enter Queen Mary's College, London, to begin training as a doctor. Later in 1951 he hopes to enter the London Hospital to complete this training. He will take his commission in the R.A.F.V.R. and spend as much time as his studies will allow flying at Redhill.

The Sword of Merit was presented by Lt. Col. R. W. Bradley, D.S.O.

Reunion

M.S.F.U. officers — Reunion at the Wheatsheaf, 25, Rathbone Place, London, W.1, at 6 p.m. on Saturday, May 20th. Details from J. G. Pickwell, 5, Cambridge Park Court, East Twickenham, Middlesex (Popesgrove 5025).

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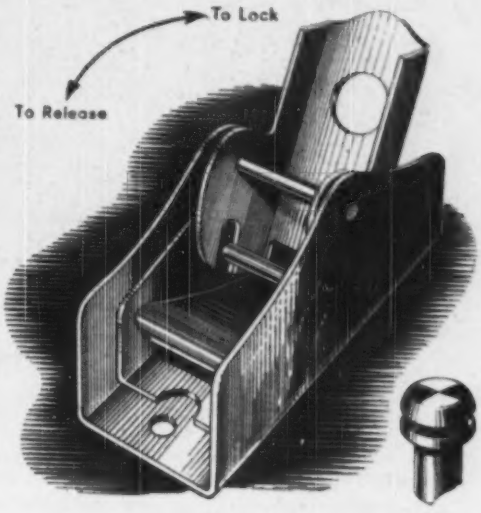

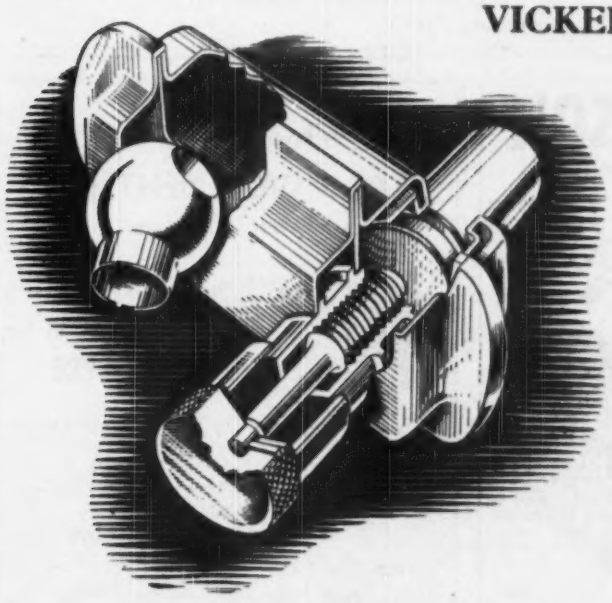

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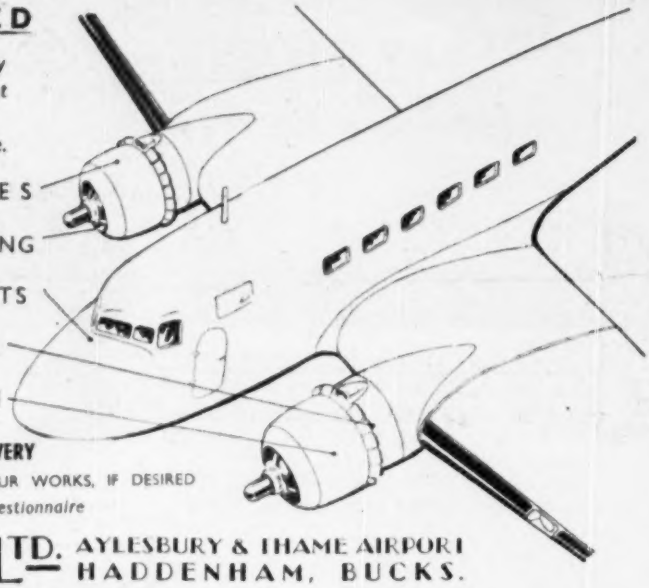

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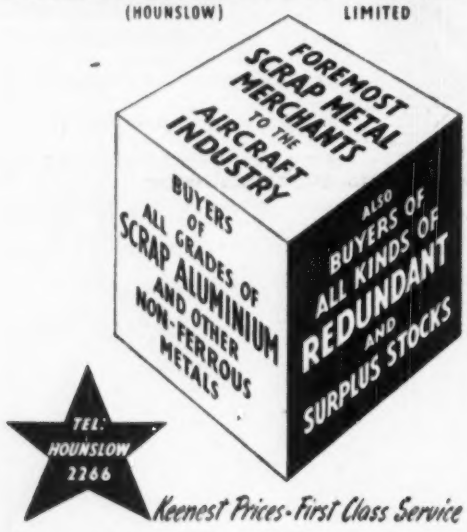
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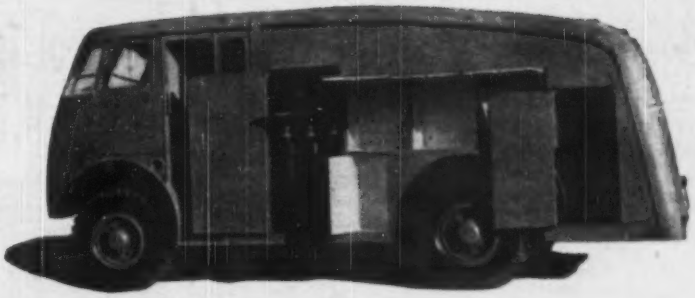

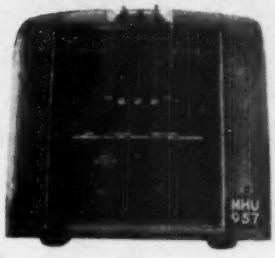

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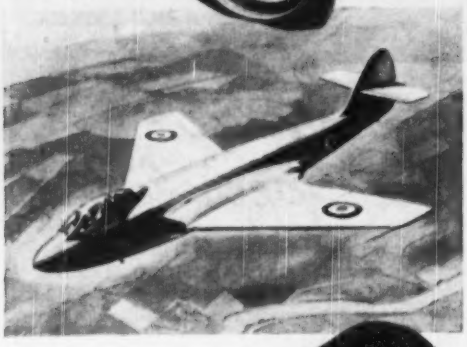

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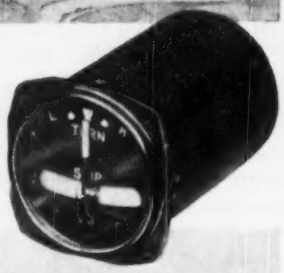

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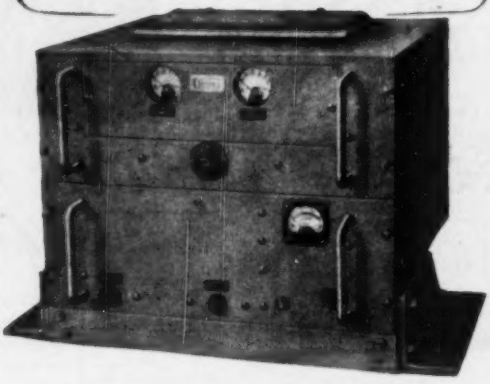

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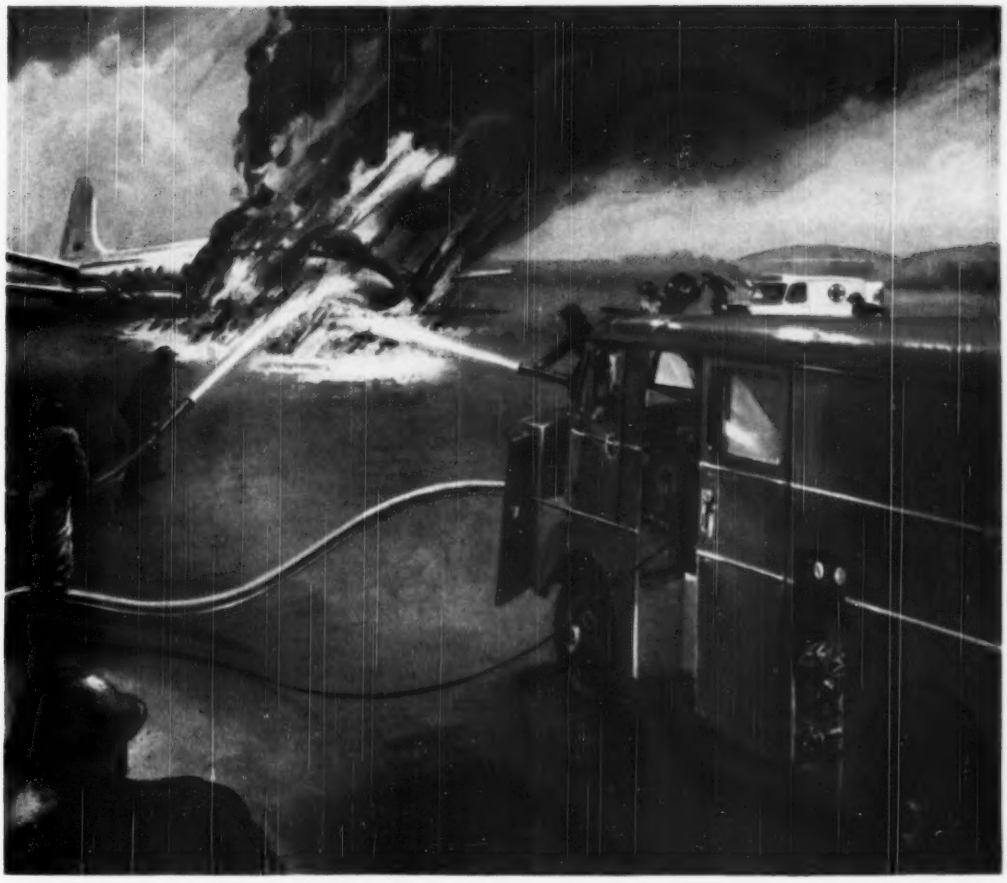

Modern—Scientific FIRE PROTECTION FOR AIRCRAFT

When an aircraft crash fire happens action must be taken in the shortest possible time—every second counts. The "PYRENE" Airfield Crash Tender shown above is the most advanced fire fighting vehicle of its kind. It is a self-contained unit capable of delivering 3,500 gallons of foam and 2,400 cubic ft. of CO_2 gas within 1¼ minutes. It carries 40 gallons of Foam Compound, 500 gallons of water, two "PYRENE" M.F.G.15 Mechanical Foam Generators and six 50-lb. CO_2 gas cylinders with two hose reels, hose and gas distributor horns. The pump, driven by power take-off, delivers 380 g.p.m. at 150-lbs. per square inch. It is built on a Thornycroft "Nubian" chassis with four wheel drive suitable for swift transit over rough or soft ground. This crash tender is capable of being brought into action within 9 seconds after its arrival at the scene of the fire. Write for full details and specifications of this and other special "PYRENE" Fire Appliances for Airfields and Aircraft Protection to Dept. F

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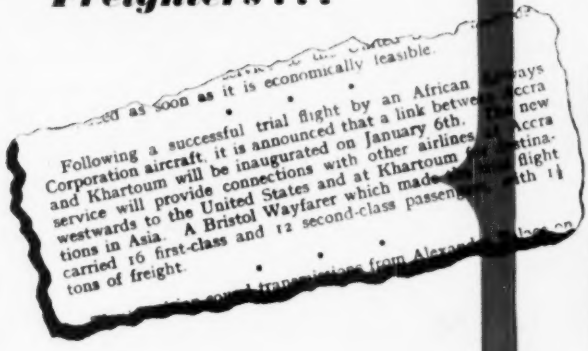
A typical "mixed bag" for "Bristol" Freighters . . .



. . . as soon as it is economically feasible.

Following a successful trial flight by an African Corporation aircraft, it is announced that a link betwe[en] and Khartoum will be inaugurated on January 6th. service will provide connections with other airlines westwards to the United States and at Khartoum [for] tions in Asia. A Bristol Wayfarer which made [the] carried 16 first-class and 12 second-class passeng[ers] tons of freight.

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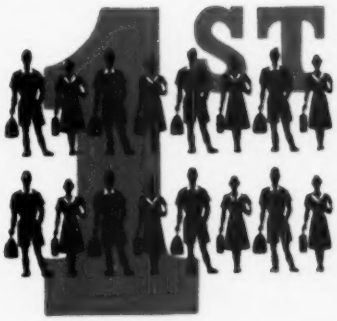

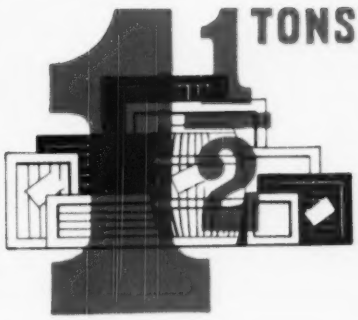

Specially converted for the carriage of 56 passengers, "Bristol" Freighters are now operated by West African Airways Corp. principally for the transport of native police. The news-cutting tells of a typical "mixed" load made possible by a special system of seating based on a "Bristol" design scheme. Double seats, extremely light in weight yet with a high standard of comfort, are removable, and with the introduction of a bulkhead it is possible to carry substantial "mixed" loads of passengers and freight.

"Bristol" Freighters operate regularly in more than twelve countries

THE Bristol AEROPLANE COMPANY LIMITED · ENGLAND